American Machinist

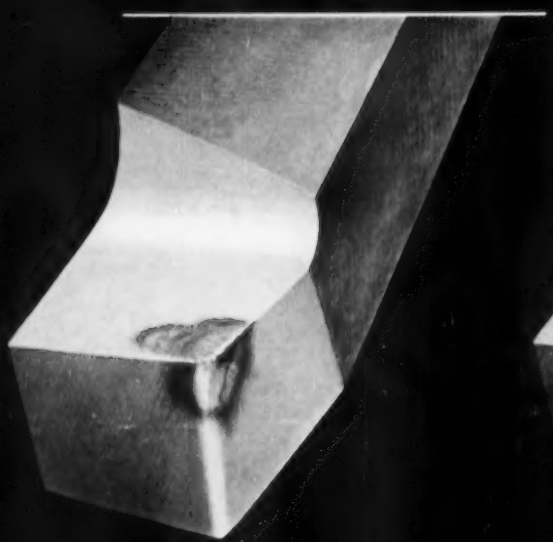
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

JULY 2, 1956 PRICE 50 CENTS

Models are tools – not toys

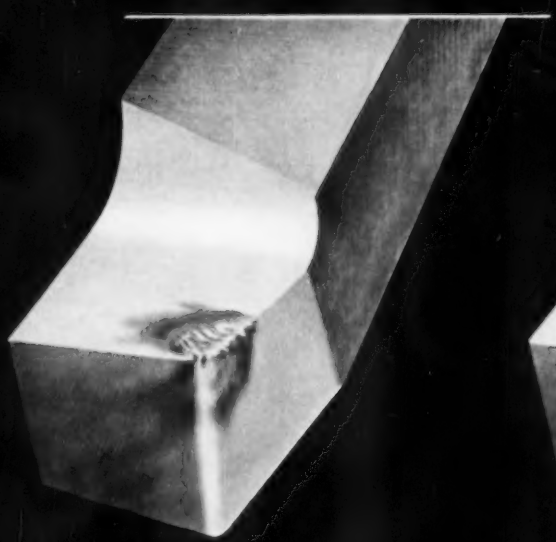
. . . A SPECIAL REPORT

Coolant filtration cuts tool cost 30%



BURNING

WORN LAND



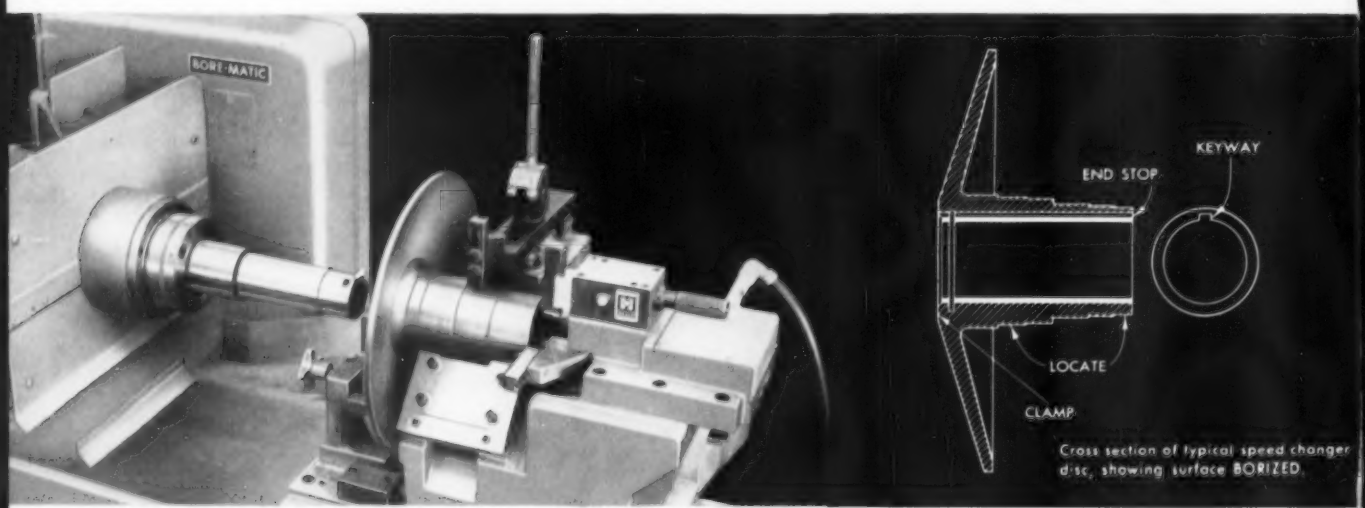
CRATERING

BUILTUP EDGE

What happens to a cutting edge — see page 2

The extreme versatility of Heald **BORIZING*** permits faster precision finishing of both long-run jobs and small-lot work with frequent changeovers

FOR EXAMPLE: *This One Bore-Matic Finishes 41 Different Parts, with a production increase of over 200%!*



Cross section of typical speed changer disc, showing surface BORIZED.

The Model 221 Bore-Matic shown above is equipped with interchangeable tooling and adjustable fixture for precision boring 41 different speed changer discs, with bore diameters ranging from 0.688" to 3.2510" and bore lengths from 2⅜" to 9⅜". Compared to the previous method of doing the same job, BORIZING increased total net production from 4 parts to 13 parts per hour.

It PAYS to come to Heald

**BORIZING is a copyrighted word meaning the application of any number or variety of precision finishing operations performed on a Heald Bore-Matic.*

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THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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NUMBER OF COPIES PRINTED THIS ISSUE 41,647

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American Machinist is indexed regularly in the Engineering Index and the Industrial Arts Index

American Machinist, published bi-weekly, with an additional issue in mid-November, by McGraw-Hill Publishing Company, Inc, James H McGraw (1860-1948), Founder. EXECUTIVE, EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: McGraw-Hill Building, 330 West 42nd Street, New York 36, NY. Donald C McGraw, President; Paul Montgomery, Executive Vice President; Joseph A Gerardi, Vice President and Treasurer; John J Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B Smith, Vice President and Editorial Director; Joseph H Allen, Vice President, Director of Advertising Sales; J E Blackburn, Jr, Vice President and Circulation Director.

SUBSCRIPTIONS: Address correspondence to American Machinist-Subscription Service, 330 West 42nd Street, New York 36, NY. Allow one month for change of address. Subscriptions are solicited only from production executives and engineers in the metalworking industries. Position and company connection must be indicated on subscription orders.

Single copies, 50c. Subscription Rates — United States and possessions, $5 a year, $8 for two years, $10 for three years. Canada $7 for one year, $11 for two years, $14 for three years. Other Western Hemisphere and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Second-class mail privileges authorized at New York, NY.

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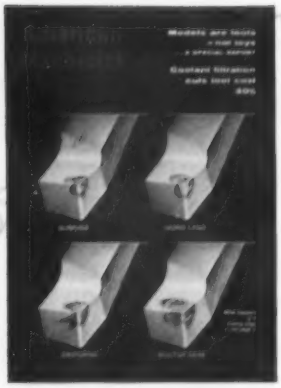


chips

CUTTING EDGES . . . The graphic presentations of what happens to a cutting edge, shown on our cover, were made from the original artwork for the animated portions of a new film made for The Texas Co by Audio Productions. The picture is called "Cutting Fluids" and is designed as a basic presentation of the action of both regular and soluble oils in preventing the development of these conditions. Actual tools will usually break down from a combination of these conditions. To show each one clearly, the producers resorted to hand-drawn overlays. The film, incidentally, is available from Texaco district offices.

COOLANT FILTRATION . . . While on the subject of cutting fluids, take a look at the article on coolant filtration for automatics. By filtering the "fines" out of coolant before reuse, Taylor Instrument Companies achieved a 15% increase in production and a 30% increase in tool life. Other gains include higher speeds and better finish.

MACHINE MODELS . . . We were struck by the number of machine-tool models on display at the Machine Tool Show in Chicago last year. We took pictures at the time of all we could find. Associate Editor George De Groat compiled our current Special Report. It shows the three types (stationary, movable, and working) and the ways in which each is used. Many photo case studies cover parts, complete machines, and plant layouts.

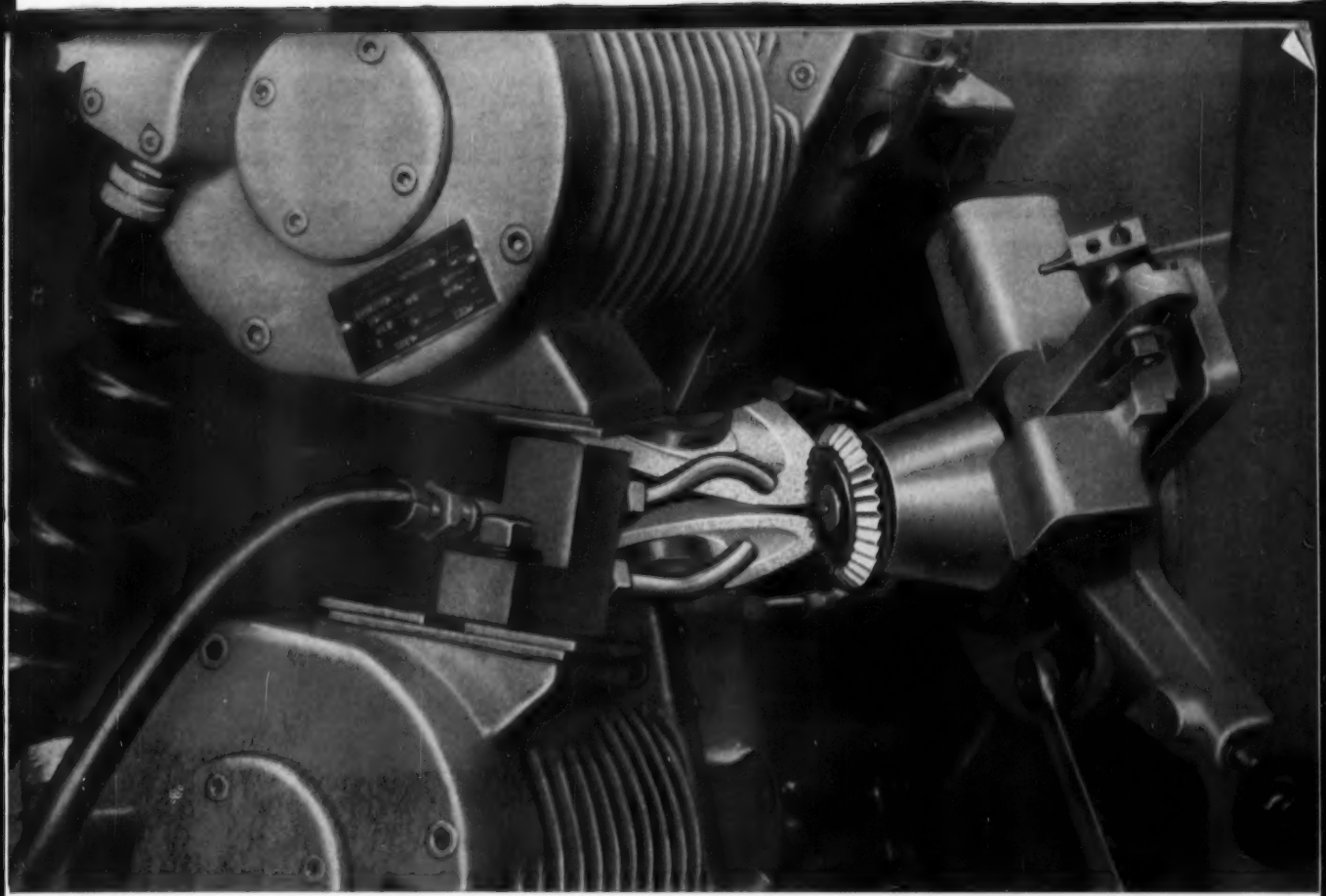
RUSSIAN IDEAS . . . Continuing our search for ideas from behind the Iron Curtain that seem to be worth study, we include three short reports in this issue: a tear-away test for depth of case in case-hardened gears, magnetic-powder inspection, and a chip-breaker.

TOOL DESIGN . . . Chipbreaker design, rake angles, and the direction of grinding marks on the tool all influence the horsepower required for cutting. Prof Kozacka (see biography) reports the results of tests with insert bits in a vertical toolholder that show the effect of each. The special dynamometer is described, too.

TOOLING IDEAS . . . Argonne National Laboratories has been the source of many unusual ideas. Herbert Ostrander describes a fixture to generate a true circular arc of large radius on various machine tools. . . . A picture spread shows four unusual setups required for a flap track at Rohr Aircraft.

COMING . . . *AM* for July 16 will be packed with special features. Starting with a cover that may represent the first and last time a camera was used inside an operating jet-engine test cell, the issue includes a round-up on "Titanium Today." This will include eight pages of remarkable color pictures showing the fabrication of titanium shrouds by Convair. There will be a report on some advanced techniques for titanium welding at Ford. It is all in the nature of a 10th birthday celebration for the new metal and you are invited. . . . The rest of the issue includes a discussion of the "building-block" approach to machine tools, articles on CO_2 welding, estimating, tumbling, salvage, and an unusual compound die.

JOSEPH S KOZACKA was born in Poland and studied at Pratt Institute and the University of Michigan, receiving his BS and MS degrees from the latter. He served his apprenticeship as a machinist and toolmaker, then joined Packard after graduation. He was director of Alliance Technical Institute, Cambridge Springs, Pa, 1918 to 1929, moving on to positions at Lewis Institute and Illinois Tech. He is now professor emeritus of mechanical engineering and head of the engineering shop laboratories at the University of Illinois branch in Chicago and a research and development engineer for Skil Corp. His report on the influence of tool design on cutting forces is our lead



Now you can grind straight bevel Coniflex® gears

You can *now* use hardened and ground straight bevel gears for many angular drives requiring extreme precision and load carrying capacity.

The new Gleason No. 105 Straight Bevel Coniflex* Grinder generates gears with the highest accuracy of spacing and profile, with the tooth profile, fillet radius, and tooth bottom formed into one smooth blended shape by two grinding wheels.

And gears ground on the No. 105 Grinder after hardening *maintain their extreme precision* even under continuous load operation.

Wet-type grinding on this machine provides fast cycles and excellent finish. Set-up calculations are simple. The completely automatic cycle of the No. 105 Grinder not only assures uniformity of production but also provides great savings in time and production costs.

We will gladly send you more information about the No. 105 Straight Bevel Coniflex Grinder upon request.

The No. 105 Grinder accommodates straight bevel Coniflex gears up to 8½" pitch diameter, 3DP with ratios up to 6:1, cone distances up to 4¼". Gears 20DP and finer may be ground directly from the solid; coarser pitches are ground after semi-finish cutting and hardening.

* Straight bevel gears with localized tooth bearing.

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Builders of bevel gear machinery for over 90 years

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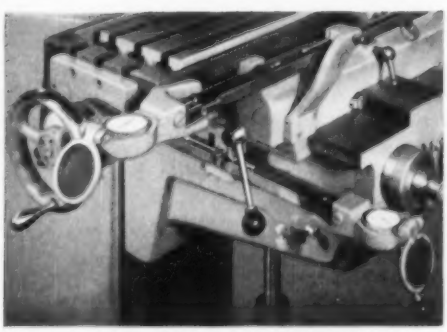
Toolmaster

Two Toolmaster attachments are shown below:
1) Swivel Vise, 2) Cutter Illuminating Attachment

Shaping Attachment

Overarm Adapter



Precision Measuring Equipment

CINCINNATI

Attachments

Stretch Toolmaster Versatility

Over More Jobs

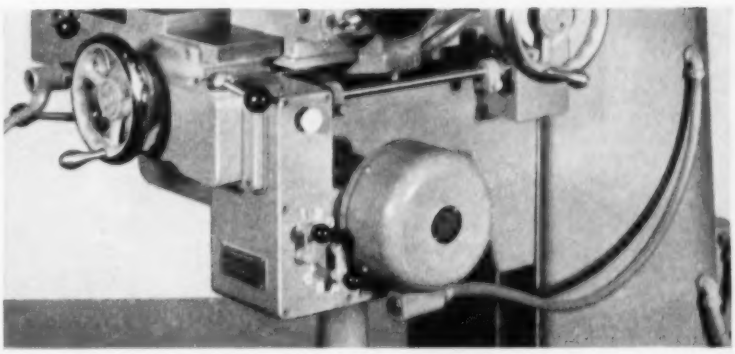
CINCINNATI

. . . and give you an opportunity to reduce the cost of dozens of machining operations performed on CINCINNATI Toolmaster Milling Machines. Eight of these attachments are illustrated here. You will find others just as profitable for your toolroom in the following list:

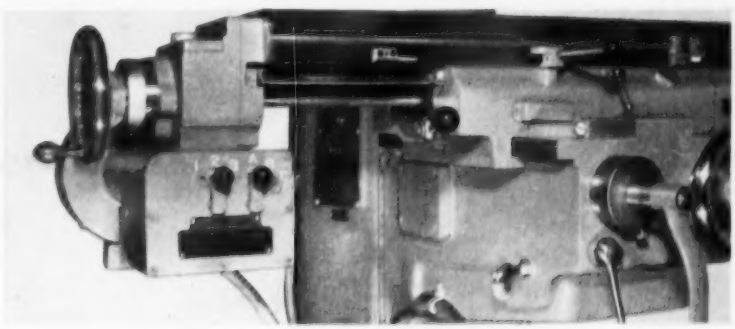
- **Power feed to table**
- **Power feed to saddle**
- **6" extra table traverse**
- **Shaping attachment**
- **Shaping tools**
- **Precision measuring equipment** (longitudinal, cross, vertical, or combinations)
- **Overarm adapter** (intermediate swivel)
- **Vises**
- **8" index head and tailstock**
- **Quill feed for 1C machine**
- **Cutter illuminating attachment**
- **Cutting fluid pump**
- **Straight cylindrical collets** (inch and metric sizes)
- **Taper hole collets**
- **Adapter for small collets**
- **Adapter for straight shank cutters**
- **Drill chucks**

You may obtain more information about Toolmaster's versatility, its rugged construction, and the fine array of attachments available by writing for Toolmaster catalog No. M-1870-3.

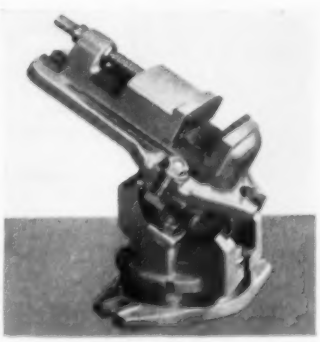
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



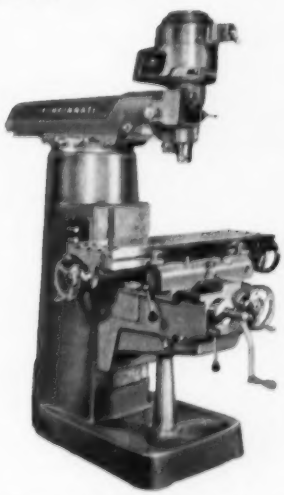
Power Feed to Saddle



Power Feed to Table



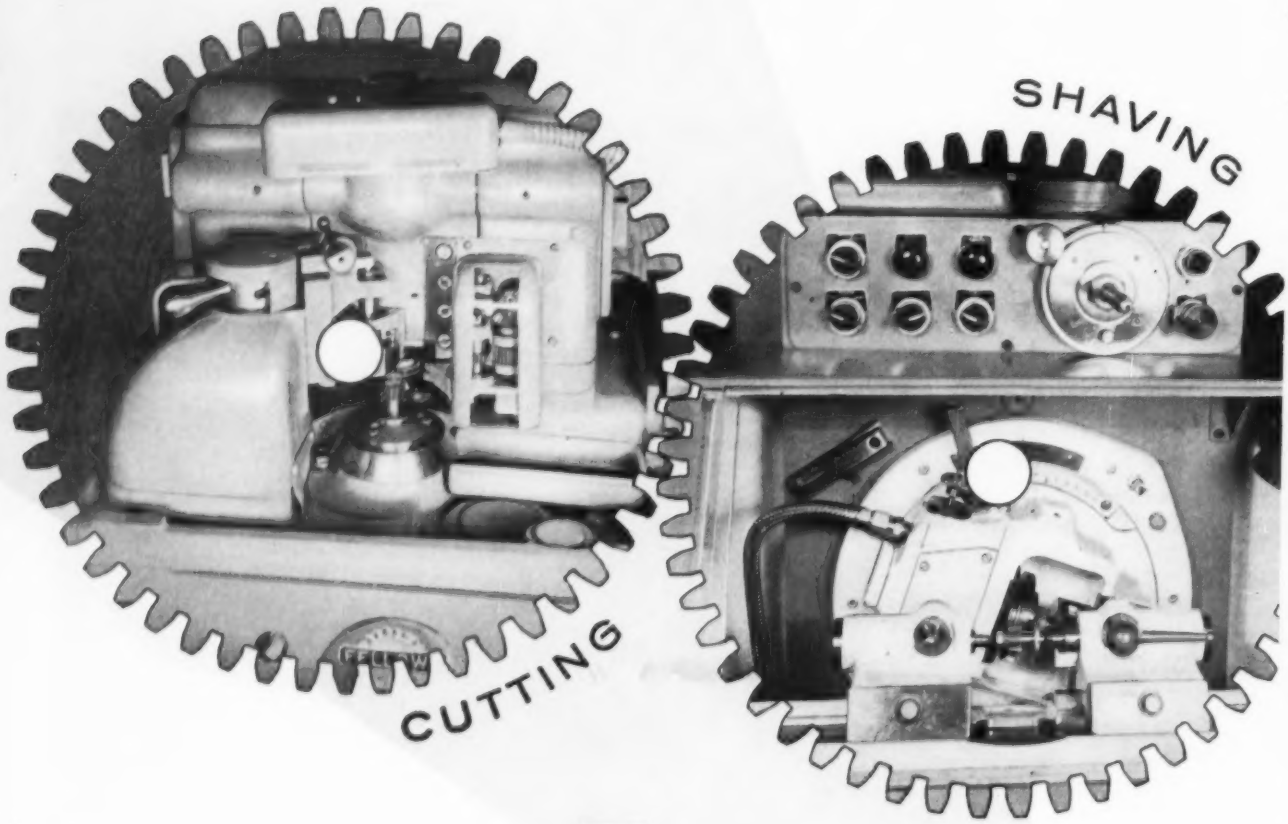
Universal Vise

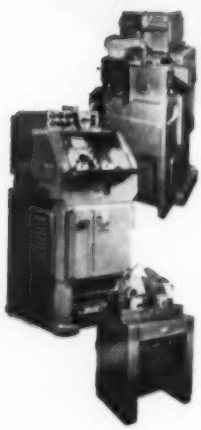


CINCINNATI® Toolmaster Milling Machine. Catalog No. M-1870-3.

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

FULLY INTEGRATED

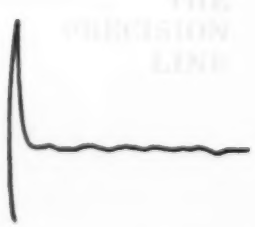




Fellows 3-inch Gear Shaper will handle work from 1/16" to 3" pitch diameter and as fine as 200 pitch on spur gears. It provides for unusually high speeds... automatic deburring, too.

Fellows No. 4 Gear Shaving Machine provides the fastest possible finishing on spur and helical gears from 1/16" to 4" pitch diameter, 1" face width, 20 diametral pitch and finer. The last word in quality.

Fellows No. 4 Red Liner is especially adapted to the "composite check" of fine-pitch precision gears. Electrical recorder amplifies errors 200, 400 or 800 to 1 and records them on a paper chart. Very fast!



PRODUCTION

FOR FINE-PITCH GEARS, TOO

At the NMTB Show, gear men had the opportunity to see for themselves how quantity production of high precision fine-pitch gears can be achieved at low cost. Using a Fellows 3-Inch Gear Shaper, No. 4 Fine-Pitch Gear Shaving Machine and No. 4 Red Liner... all fully integrated... production speeds can be obtained that a short time ago were considered impractical. Simultaneously, close tolerances can be assured which will meet the most exacting gear-train requirements for electronics and instrumentation.

If you are interested in fine-pitch gears... either as a producer or user, or both... it will certainly pay you to get all the facts about Fellows line of fully integrated equipment. WRITE, WIRE or PHONE any Fellows Office today!

THE FELLOWS GEAR SHAPER COMPANY.
Head Office and Export Department: 78 River Street, Springfield, Vermont.
Branch Offices: 319 Fisher Building, Detroit 2 • 5835 West North Avenue, Chicago 39.
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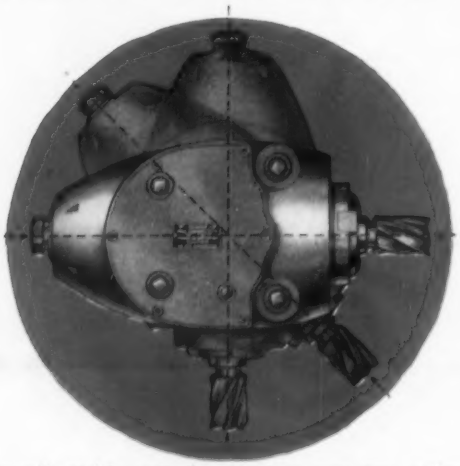
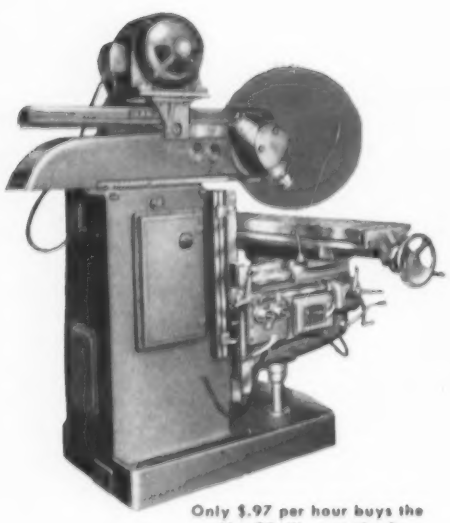
Fellows *Gear Production Equipment*

VAN NORMAN Ram Type Millers DO THE WORK OF TWO SINGLE PURPOSE MACHINES ...PLUS *Angular* Milling without Attachments



The adjustable cutterhead gives you two millers in one. Enables you to do horizontal, angular or vertical milling. It eliminates idle machine time . . . helps you increase production . . . cut costs.



Only $.97 per hour buys the No. 28, illustrated, after minimum down payment on 5-year-conditional sales contract.*

No matter what your milling requirement, you simply can't beat Van Norman Ram Type Millers for getting out more pieces per worker-hour, per shift.

So why invest in two single purpose machines and attachments when *One* Van Norman Miller does the work of two, plus angular milling without attachments?

Write for complete details, now.

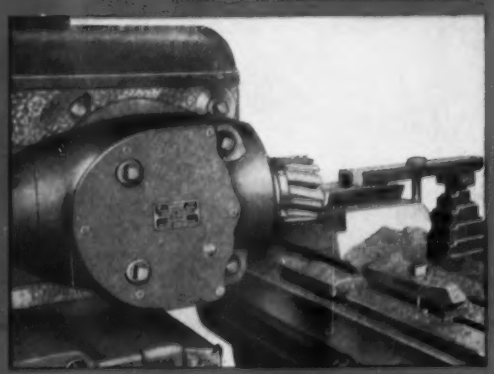
Don't wait . . . for extra profits install a Van Norman Machine Now!
They are available on many purchase plans — Outright sale . . .
Purchase on conditional sales contract up to 5 years . . .
Pay as you depreciate . . . See your dealer or write
Van Norman Company. Conditional Sales Contracts not available to Export.

VAN NORMAN MACHINE

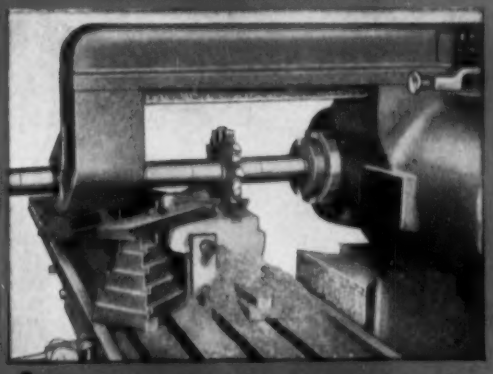
MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

1. With the cutterhead locked in the vertical position, a milling operation is performed on the workpiece.

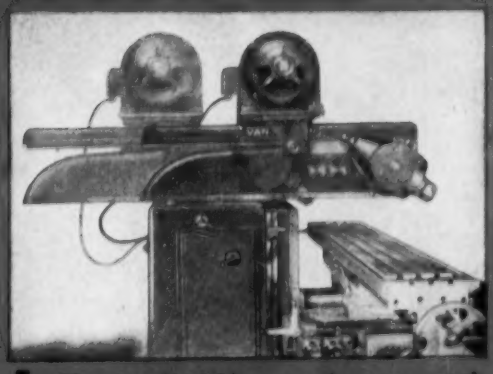
2. An angular milling operation being performed on the same workpiece . . . angular range of cutterhead is 0 degrees to 90 degrees. Note the workpiece is still in the same position.



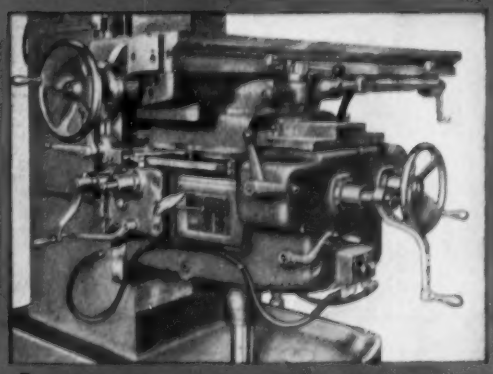
3. With the workpiece in the same set-up and the cutterhead in horizontal position, two square faces are milled in the work. Note the workpiece set-up has not been changed.



4. With the cutterhead in horizontal position, a slot is milled in the same workpiece. Overarm and outer brace provide maximum rigidity. Note work position has not been changed.



5. Heavy adjustable ram increases work range . . . permits maximum cuts to the full capacity of the motor. Ram movement 29". Ram scale makes positioning easy.

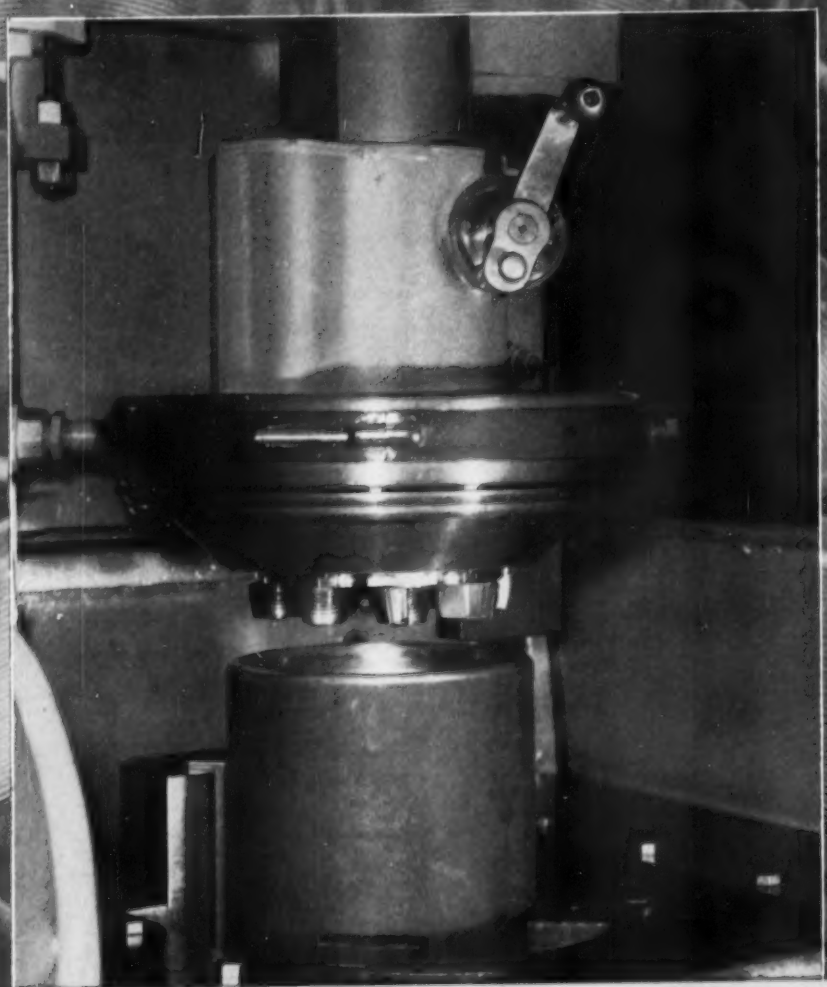


6. Front and rear directional controls simplify operation. This dual control saves time and reduces worker fatigue. Exclusive Van Norman single lever feed selector permits quick, easy

COMPANY

SPRINGFIELD 7, MASSACHUSETTS

LARGE CASING



THE LANDIS Machine CO.

• • • THE WORLD'S LARGEST MANUFACTURERS OF

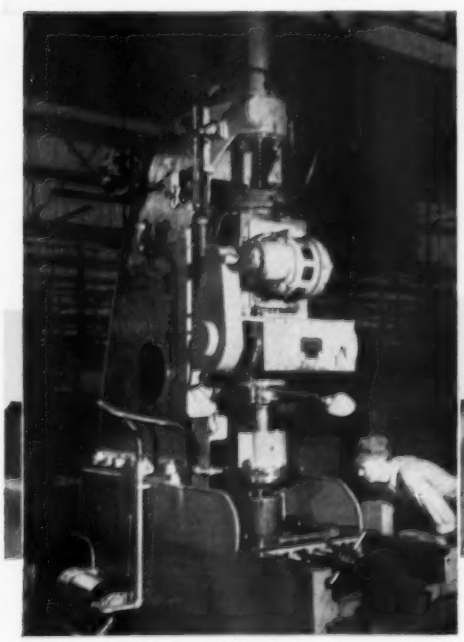
374-3C

THREADS TAPPED IN 12 MINUTES...

BAKER OIL TOOLS, INC., of Los Angeles, California, reports that a *LANDIS* CBLM Circular Chaser Tap mounted on a Stamet's vertical tapping machine has reduced threading time 75%, tapping 6⅝" to 13⅜" diameter threads in casing shoes.

Production examples illustrate the large savings made in threading time: (1) tapping 13⅜" N-80 tubular stock, oil well casing shoe with 8 Pitch API round threads 5" long requires but 12 minutes; (2) tapping a 6⅝" piece with an 8 pitch API round thread 5" long takes only 8 minutes. Formerly, threading a typical casing shoe would have required all of 40 minutes.

The *LANDIS* CBLM Tap, as used at Baker, is designed for use on production tapping machines to thread line pipe, casing, and drill pipe couplings. The tap head is detachable, and with the use of the various size tap heads available, the CBLM Tap will tap threads ranging from 4½" to 13⅜" O.D. It will cut either 3/16", ⅜", or ¾" tapered threads well within all API Standards, and can also be arranged for straight threading. Infinite taper adjustments are possible either above or below the required degree of taper to assure precision accuracy.

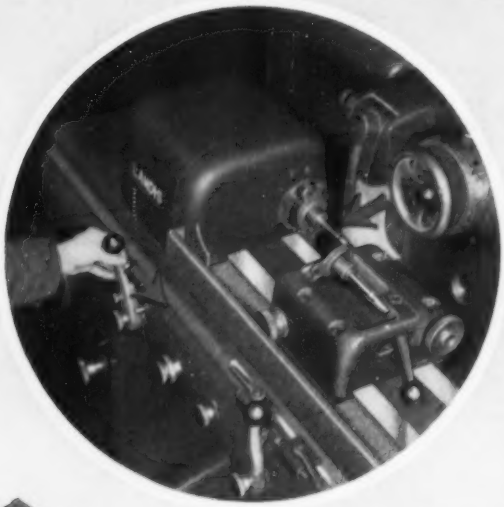


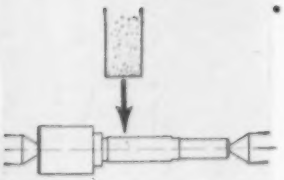
LANDIS manufactures a wide variety of taps for the economical production of internal threads ranging from 1¼" to 13⅜", either straight or tapered threads, on both stationary and rotating spindle machines. For complete information write for our new Bulletin No. G–93.

LANDIS WAYNESBORO PENNSYLVANIA

THREAD GENERATING EQUIPMENT

Landis automatic cycle cuts

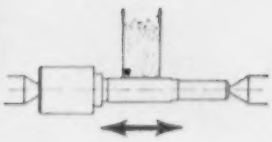




1 Operator moves infeed lever. Wheel head moves rapidly to grinding position by hydraulic power. Work rotation and coolant flow begin.

Landis 4" x 18" Type H Plain Cylindrical Grinder with extra cost semi-automatic cycle. Write for catalog A-54.

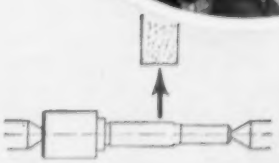
unit grinding costs up to 50%



2 Hydraulic slow grinding feed and hydraulic traverse operate automatically. Operator changes dogs on workpieces during grinding period.

3 Wheel automatically moves back after work has been ground to pre-set size. Coolant stops and infeed lever re-sets.

4 Operator moves footstock lever to unload and load workpieces. Cycle ready to repeat.



LANDIS
precision grinders

LANDIS TOOL COMPANY
WAYNESBORO, PENNSYLVANIA

Plane steel or cast iron Giddings & Lewis new Double

AT tool speed of 400 feet per minute, steel or cast iron chips literally "ZIP" off the workpiece. With speeds like this, you can double present-day production with Giddings & Lewis' new Hypro Double Housing Planers.

Now for the first time anywhere, G&L Hypro advanced-design planers offer table speeds ranging from 25 to 400 feet per minute . . . permitting you to take full advantage of the greater productivity of tungsten-carbide or other high-speed cutting tools. In addition, these machines have exceptional ability to maintain precise tolerances under the most severe cutting pressures.

Outstanding features of the machine include: dual saddle and slide controls; power cross-feed to side heads; extra-heavy cross-rail; electric rail clamp; twin-helical table drive gearing; extra-high pneumatic tool lifters on both rail and side heads; hydraulic table stops and jacks, and new design heavy box-section housings. You get 100% table support for added strength and machining accuracy, thanks to massive construction of the full double-length bed.

Giddings & Lewis adjustable voltage motor-generator set and the double-capacity table drive motor provide fast acceleration, deceleration and reversing — plus maximum power for short stroke planing operations.

For complete specifications and features, see your nearest G&L representative, or write direct to Giddings & Lewis Machine Tool Co., Fond du Lac, Wisconsin.

Literature Available:

Ask for Bulletin No. 250 with details on new Hypro Double Housing Planers.

GIDDINGS & LEWIS MACHINE TOOL CO.

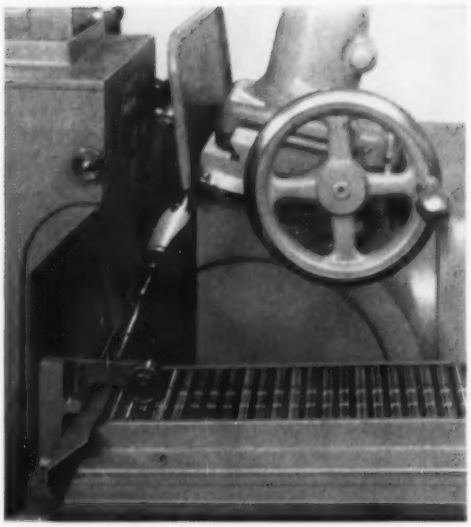
FOND DU LAC, WISCONSIN

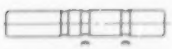
Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

G-56

at 400 FPM with Housing Planers

Here's carbide planing of steel and cast iron at 400 feet per minute. Both rail heads are equipped with Davis Shear Angle Clamped-on carbide insert planer tools.



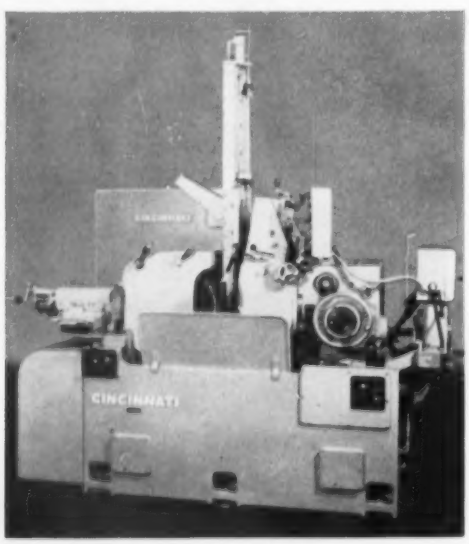


Pump shafts. A magazine type work loading fixture and automatic infeed attachment help to reduce the cost of grinding bearing grooves. CINCINNATI FILMATIC No. 2 Centerless Grinder.

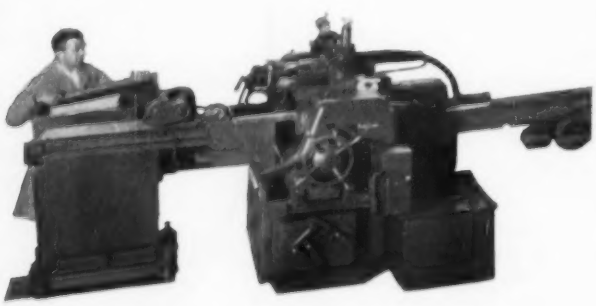
...and Cincinnati Centerless

can reduce costs

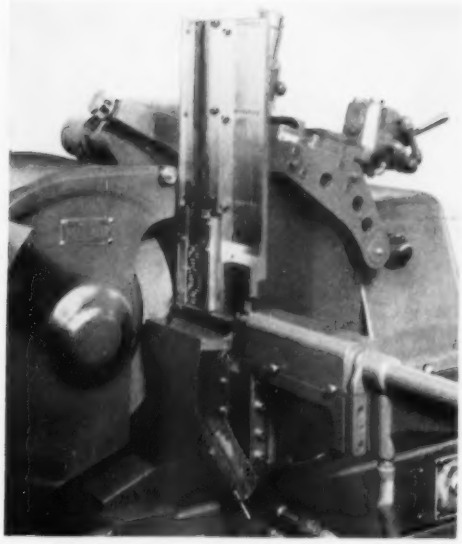
Some old, some new... but all of them show various degrees of automation designed and built for CINCINNATI® Centerless Grinders by Cincinnati grinding specialists. These men can draw upon 33 years' experience in this type of work. And you can be sure that they will give you the benefit of the most advanced thinking in



Universal joint spiders. An ingenious mechanism combines loading and transferring the parts from one pair of wheels to the next. Four diameters are automatically ground each cycle. CINCINNATI FILMATIC No. 2 Centerless Grinder.



CINCINNATI



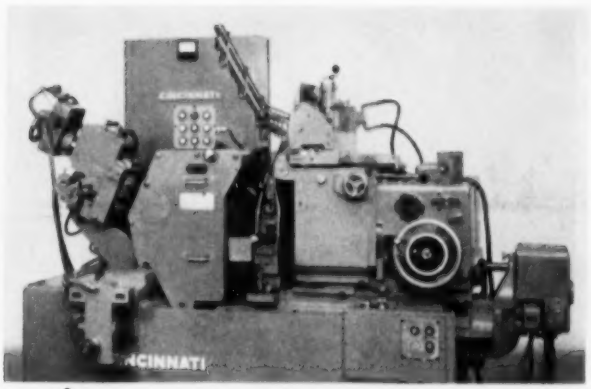
Twist drills. Nine years ago, when Cincinnati grinding specialists equipped this CINCINNATI FILMATIC No. 2 Centerless to automatically grind twist drills, Cincinnati already had more than 20 years' experience in developing high production centerless grinding methods.

Automation

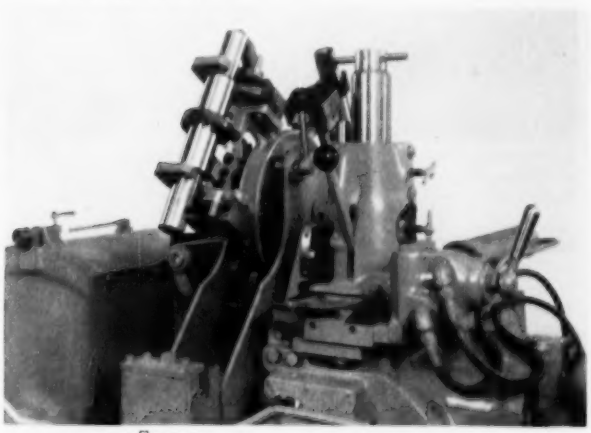
in your shop, too

centerless grinding methods. That's one of the big reasons why it will pay you to consider Cincinnati first. Only Cincinnati can give you the advantage of long experience and a choice of six sizes of centerless grinders. May we hear from you?

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



Automotive valves. Two accurately spaced grooves and two bevels are ground in the stem, in one operation, from the solid. Automation features include cycle time stabilizer; automatic truing; cam regulating wheel. CINCINNATI FILMATIC No. 2 Centerless Grinder.

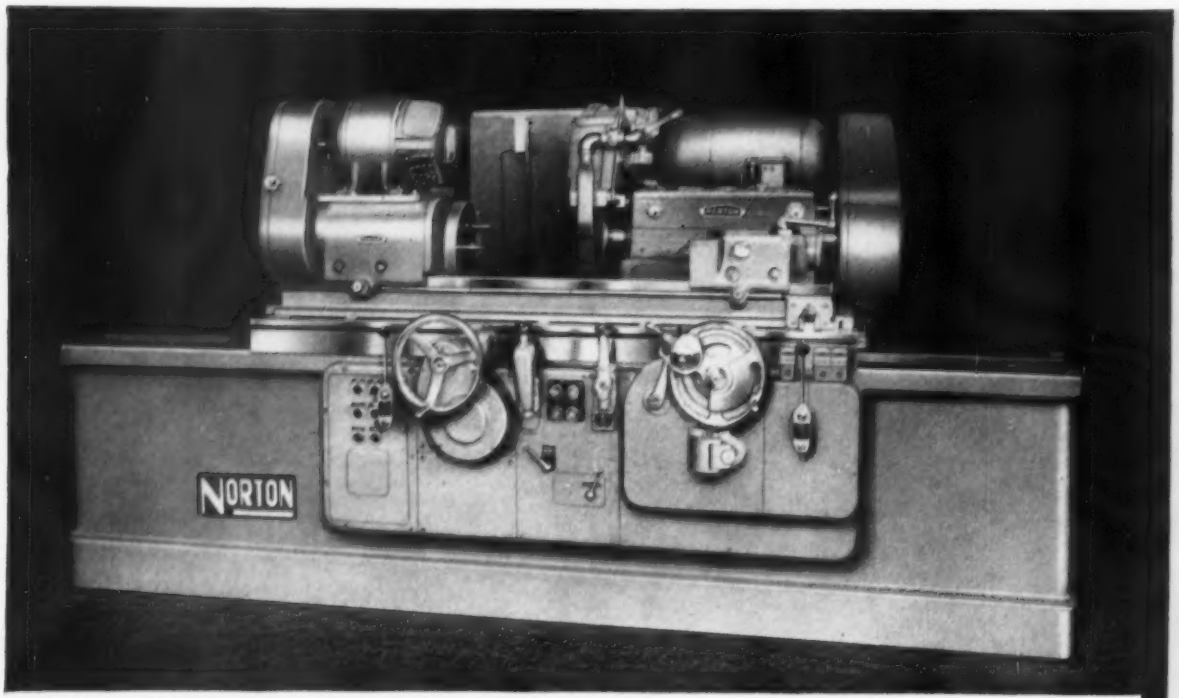


Track roller shafts. Two diameters with heavy and variable amounts of stock are automatically ground on three sizes of these parts. CINCINNATI FILMATIC No. 3 Centerless, equipped with automatic loading fixture and electro-hydraulic automatic infeed attachment.

Rocker arm shafts are loaded into the hopper at the left and transferred by conveyor from one CINCINNATI FILMATIC No. 2 Centerless to the next, and finally through the CINCINNATI FILMATIC Centerless Lapper at the far right.

FILMATIC

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES



A NORTON TYPE CTU SEMIAUTOMATIC CYLINDRICAL GRINDER. The fastest, most economical and versatile grinding machine of its type. One-lever control of the automatic grinding cycle reduces the operator's duties to loading and unloading. Both the 6″ and 10″ Type CTU's are available as semiautomatics or as plain machines.

Norton Type CTU Cylindrical Grinders are packed with features for...

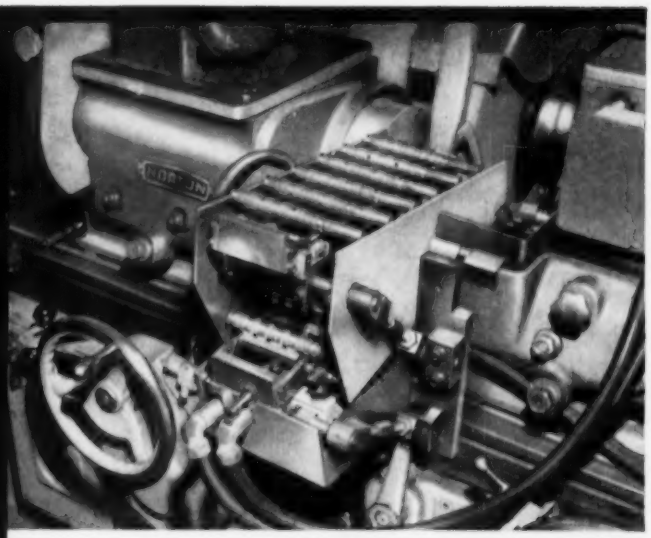
profit-boosting automatic operation

Production line and job shop users report that Norton 6″ and 10″ Type CTU cylindrical grinders have doubled and tripled production, replaced several machines and eliminated costly extra operations.

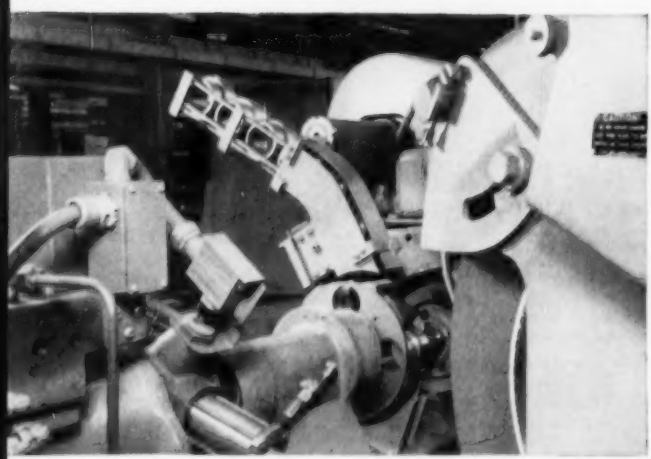
That's because of the many time-and-work-saving "Touch of Gold" features — standard and auxiliary — available with these grinders.

Some of the expertly automated auxiliary features are described here. Check them carefully — and figure their value to your own cylindrical grinding operations. And remember: only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. For further facts, see your Norton Representative, or write to NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

THE SWIVALIGN* ELIMINATES CUT-AND-TRY. Another Norton "Touch of Gold" development for faster, better, lower cost grinding. The SWIVALIGN Dual Electric Indicator, available for Norton cylindrical and universal grinders, enables operators to adjust the angular positions of swivel tables quickly and accurately, eliminating the usual cut-and-try guesswork. Featuring positive response and easy operation, this accurate instrument saves grinding time and money.

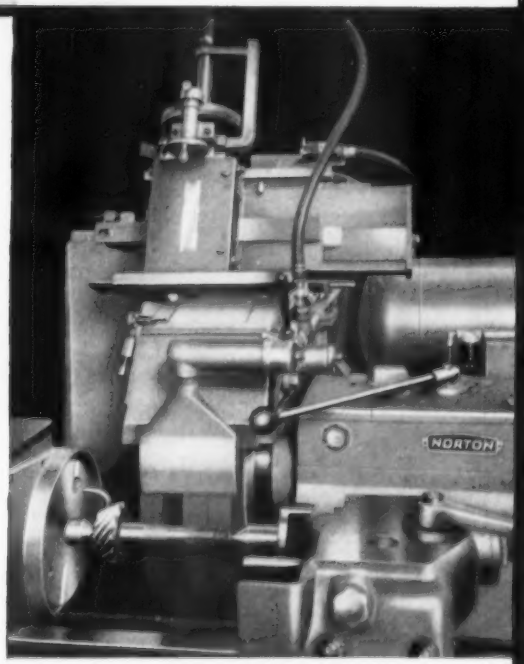


RAIL TYPE



TURRET TYPE

YOUR CHOICE OF AUTOMATIC LOADING DEVICES. Two types of Norton automatic loading devices are obtainable with 6" and 10" Type CTU semiautomatic grinders. The rail type loader is designed to handle a variety of small shafts. The turret type loader handles workpieces which must be chucked. Thanks to their steadily paced, automatic operation these Norton-developed loading mechanisms can be adapted to full automation. Or, they make it possible for one operator to tend a battery of machines, speeding production and cutting unit costs day after day.



WHEEL HEAD MOUNTED AUTOMATIC TRUING OFFERS BIG ADVANTAGES. A Norton automatic truing device, as shown here on a Type CTU grinder, quickly repays its original cost. It speeds up production, increases wheel life and increases diamond life. Also, it decreases the skill and effort required with hand truing. Operation is extremely simple. Once the original settings are made, all you do is push a button. Then the diamond automatically makes its round trip across the wheel face, at pre-determined speed and feed. Easy adjustments assure correct settings for each job . . . Another step forward in automatic grinding!

NORTON

GRINDERS and LAPPERS

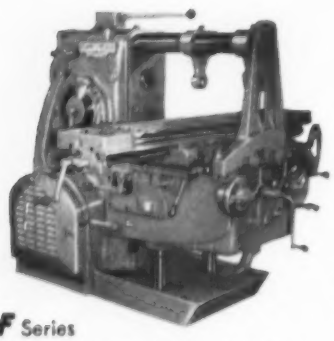
Making better products. . . to make your products better

District Offices: Worcester • Hartford • New York Area, Teterboro, New Jersey • Cleveland • Chicago • Detroit

*SWIVALIGN — Norton trade name for Dual Electric Indicator for accurate measurements of swivel table adjustment.

New Kearney & Trecker's

Controls on new TF Series milling machines are conveniently grouped up-front where they belong — to speed production . . . assure accurate settings . . . reduce operator fatigue



Available under Tool-Lease program

TF Series
Model 210 Plain Milling Machine

POWER — 10hp spindle drive; 3hp feed and rapid traverse drive
TABLE WORKING SURFACE — 62" x 14"
FEEDS — (32) ½ to 90 ipm
SPEEDS — (24) 15 to 1500 rpm
WEIGHT — 9200 lbs.

ONE look tells why the new TF Series milling machines — Plain, Universal and Vertical — are so easy to operate. "Bull's-eye" up-front control grouping permits operators to achieve exact settings faster, more adeptly and with greater ease than ever before. This "Fron-Trol" convenience is the key to low-cost production . . . because it increases the operator's efficiency and measurably reduces fatigue through elimination of wasted steps.

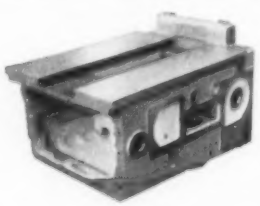
The "bull's-eye" knee and saddle-mounted controls are safety-interlocked and include feed selection, directional Mono-Lever table feed and rapid traverse, automatic cycle table feed and rapid traverse controls, front-mounted table handwheel, saddle clamping gib and backlash eliminator, and hand and power directional controls for knee and saddle movements.

In addition, the new TF's give you a superior combination of outstanding design and operating features never before available on any other knee-type milling machines. They're built in five sizes — No. 2 to No. 6 from 10hp to 50hp.

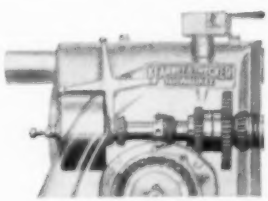
Why take less than the latest when you want new milling machines? You can get all the facts on new TF Series machines from your Kearney & Trecker representative—call him or mail the coupon to factory today!

A few more of many reasons why TF Series milling machines are so easy to operate

Twin Screw Knee Support — Exclusive double-support arrangement most effectively distributes weight of the new machines' much larger, wider, heavier knee, saddle and table. This balanced design substantially increases stability under heaviest loads . . . offers greater resistance to torsional thrust under all cuts . . . halves the wear factor, assuring greater, longer-lasting accuracy.



Heavier, Wider, One-Piece Knee — The *Twin-Screw* arrangement supports the heavier, larger knee. Span and length of ways is increased considerably, providing fuller saddle support . . . longer-lasting accuracy.



Three-Bearing Spindle — Complete assembly consists of three heavy-duty bearings, flywheel, train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life and quieter operation.

KEARNEY & TRECKER CORP.
6786 W. National Avenue, Milwaukee 14, Wisconsin

Please send me Catalog No. TF-50 with details on the new line of TF Series Plain, Universal and Vertical milling machines.

Name.....
Title.....
Company.....
Address.....
City.....Zone.....State.....

Massive Column — Solid back, double-box section column is scientifically ribbed throughout to rigidly withstand heaviest cutting forces. Full bearing column face affords maximum support for the knee. Cross-mounted motor assures maximum ventilation, and permits easy access for routine maintenance.

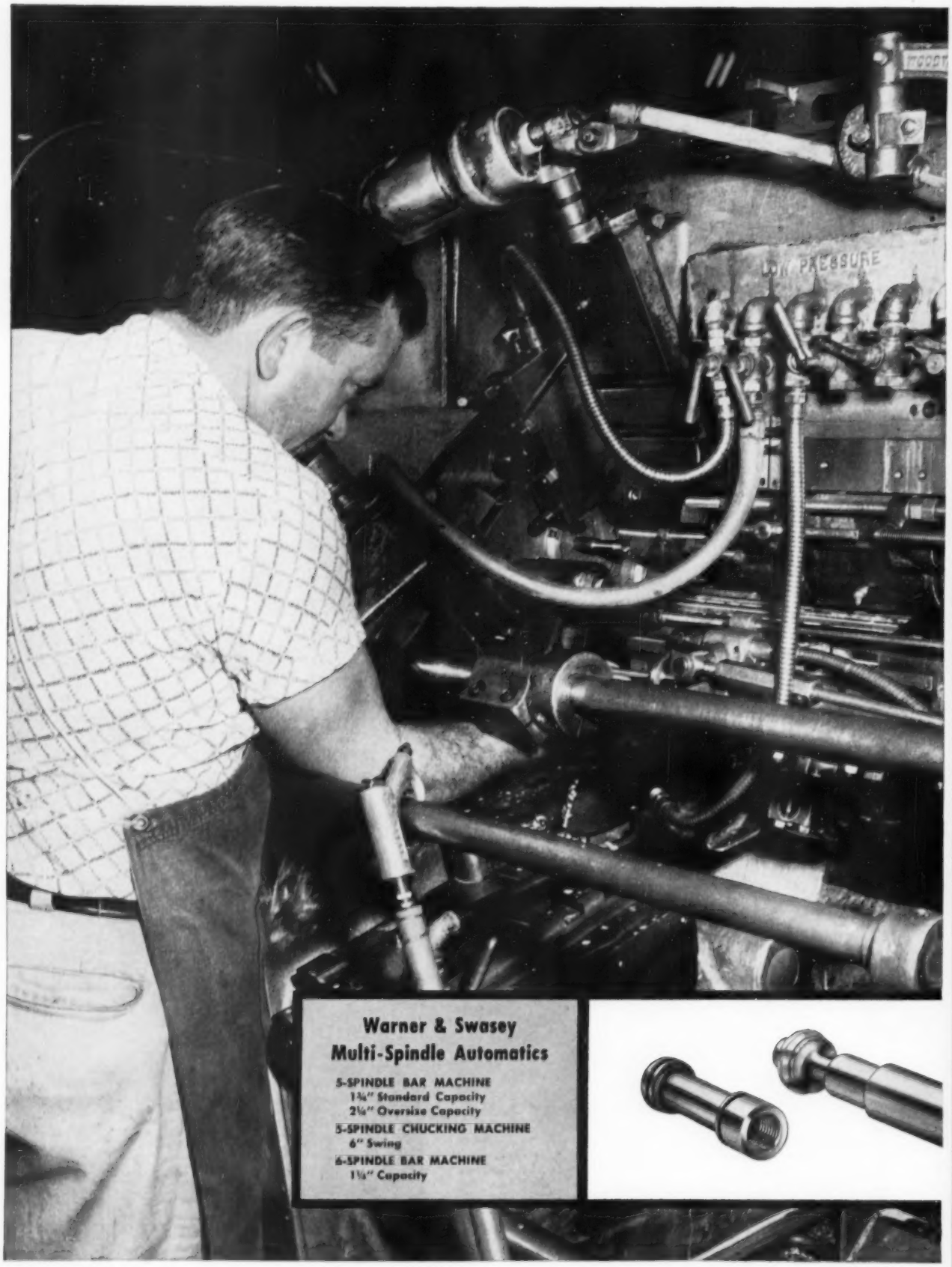
"Bull's-Eye" Control Grouping

FRONT-MOUNTED CONTROLS

1 — Single shot saddle-table and mechanism way lubricator
2 — Backlash eliminator
3 — Table clamp
4 — Adjustable saddle clamping gib
5 — Mono-Lever and Automatic Cycle Table Control
6 — Quick change feed selector
7 — Hand and power knee controls
8 — Hand and power saddle controls
9 — Front-mounted table handwheel
10 — Knee lubrication filter
11 — Spindle "start-stop"
12 — Rapid traverse control — knee, table and saddle.

KEARNEY & TRECKER
MILWAUKEE

BUILDERS OF PRECISION AND PRODUCTION MACHINE TOOLS SINCE 1898



Warner & Swasey
Multi-Spindle Automatics

5-SPINDLE BAR MACHINE
1¾" Standard Capacity
2¼" Oversize Capacity

5-SPINDLE CHUCKING MACHINE
6" Swing

6-SPINDLE BAR MACHINE
1¼" Capacity

WARNER & SWASEY AUTOMATIC CUTS SMALL LOT COSTS...

solves inventory problem for Cleco Division, Reed Roller Bit Company

Cleco Division, Houston, Texas, manufactures a wide variety of air tools. About 6000 different component parts must be machined each year—and, in order to keep reasonable inventory, in relatively small lots ranging from 100 to 1000 pieces.

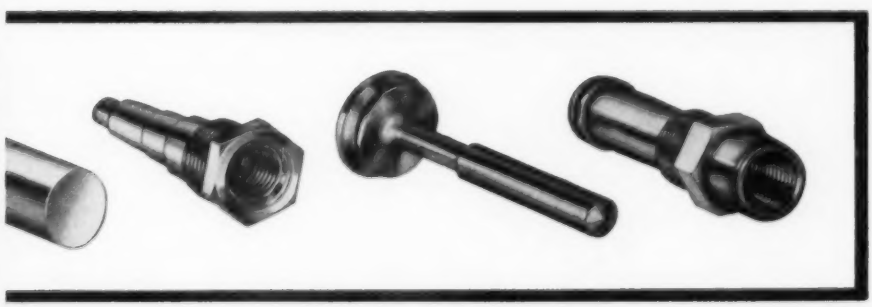
While production on small hand-operated turret lathes kept inventory in line, it resulted in too high a cost per piece. On the other hand, economical production on conventional automatics required larger lot sizes and higher inventories.

In 1948, Cleco installed a Warner & Swasey 5-Spindle Automatic to solve both these problems. Its quick setup permits machining small lots at automatic rates—reducing cost per piece, and inventory at the same time.

This automatic has been operated on a two-shift basis—the equivalent of 16 years of one-shift production—with an exceptionally low record of downtime. Only $144 has been spent for repair parts. And despite this usage, cross slide form cuts to within .002" are easily held.

Foreman O. R. Palmer says: "We handle as much of our short run work as possible on the Warner & Swasey. Only when there's more such work scheduled than the machine can accommodate do we route the surplus to other automatics." Cleco operators like the automatic's quick-set quadrants which eliminate cam changing for feed strokes, its micrometer-dial cross slide adjustment, and general ease of operation.

If you'd like to reduce your machining costs on small and medium lot production—as well as long runs—call in our Field Representative. He'll be able to tell you whether your work can be done more profitably on a Warner & Swasey Multi-Spindle Automatic.



WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

MEET
THE MOST COMPLETE CUTTING TOOL LINE
MORSE CARBON TOOLS

"MR. MORSE"

. . . the biggest and fastest all-around man in the cutting tool industry . . . your Morse-Franchised Distributor

He's got the most complete line . . . the right cutting tools for every operation from the automated production lines of the biggest mass manufacturers, to the smallest job shop.

Carbon . . . high speed . . . tungsten carbide, tipped or solid . . . you name it and he's got it . . . *right now, when you want it! He can recommend the right tool for any job,* regardless of tool requirements. That's why Morse means "The Most" in Cutting Tools . . . because your Morse-Franchised Distributor can do *the most* for you . . . any time you call on him. So call on him today for any current requirements.

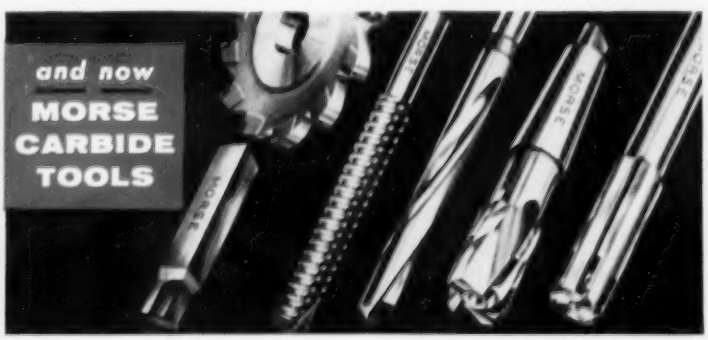
MORSE means "THE MOST" in Cutting Tools

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS

Subsidiary of VAN NORMAN INDUSTRIES, INC.

Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

Buy them by phone from your Morse-Franchised Distributor and save ordering time



minor diameter and 28 involute serrations

in this automotive rear axle differential side gear

LAPOINTE-BROACHED

in LESS THAN 4 SECONDS!

It may sound incredible, but the fact is that a production rate of 960 broached parts per hour is maintained on this fast LAPOINTE Vertical Pull Down Broaching Machine!

Here's how it's done: The machine operates on a 15-second cycle, broaching 4 steel-forged parts at a time; machine has a fully automatic belt conveyor unit which can be loaded by the operator at the preceding machine, or automatically from plant conveyor system. (The machine automatically stops if blanks cease coming on conveyor belt.)

You should convert to Lapointe-Broaching, if you are producing gears or other parts similar to this one . . . or if you are making *electric motor laminated stator cores.* Why not invite a Lapointe Field Engineer to show you how to cut production costs with Lapointe Broaching?

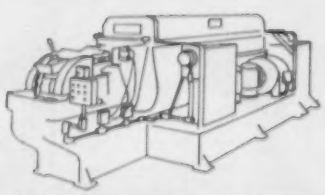
THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS · U.S.A. *In England: Watford, Hertfordshire*

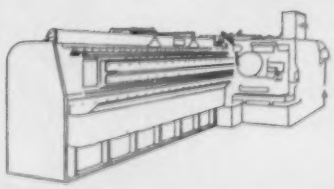
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE

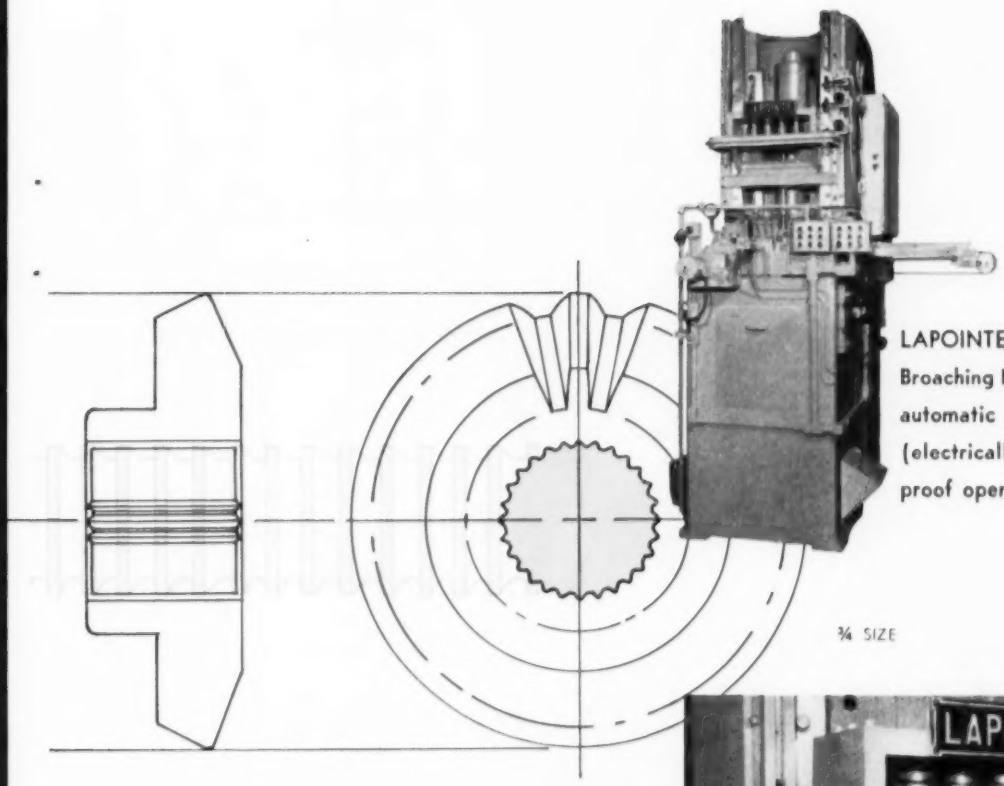
60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



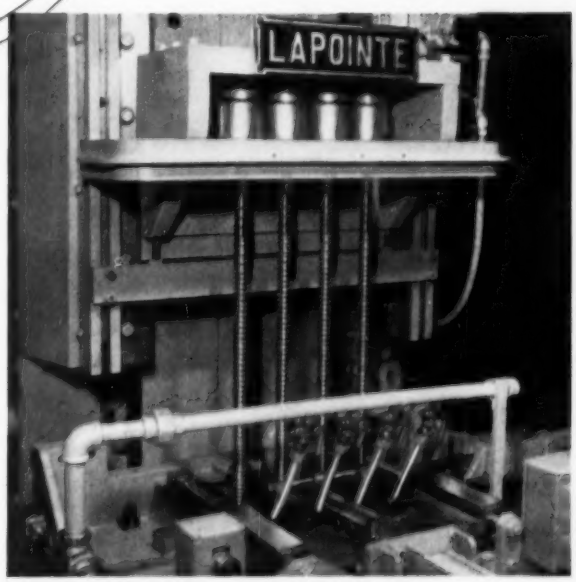
SRHE SINGLE RAM HORIZONTAL, ELECTRIC



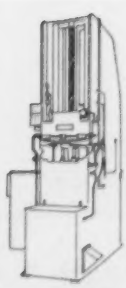
LAPOINTE V3 Vertical Pull Down Broaching Machine, equipped with automatic part conveyor unit (electrically interlocked for fool-proof operation).

¾ SIZE

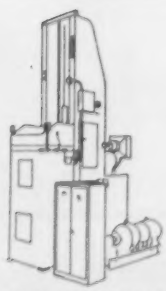
LAPOINTE takes all the responsibility for your ***continuous broaching*** program. We build the broaching machines, build the broaching fixtures, and make the broaches!



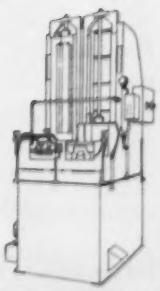
Close-up of fixturing and tooling.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

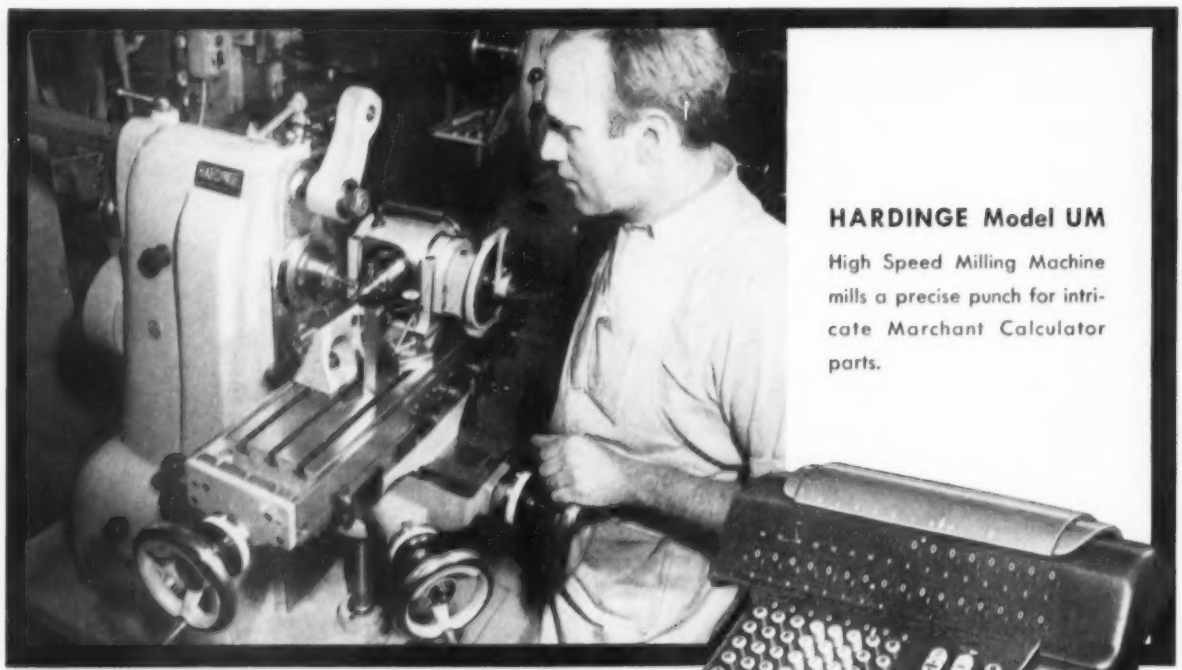
known to be the best in

BROACHING

HARDINGE
ELMIRA, N.Y.

HIGH SPEED MILLING MACHINE FOR PRECISION TOLERANCES

at Marchant Calculators, Inc., OAKLAND, CALIF.



HARDINGE Model UM

High Speed Milling Machine mills a precise punch for intricate Marchant Calculator parts.

High Speed Automatic MARCHANT Figuremaster

PRECISELY MACHINED . . . close tolerance components of Marchant calculators—each functioning with lightning speed—are a tribute to American engineering and make this line of calculators a leader in American business equipment.

HARDINGE High Speed Precision Milling Machines are used by Marchant Calculators, Inc. to produce highly precise tolerance pierce-punches. Milling operations are performed efficiently with speed and accuracies to tenths of thousands of an inch.

For your precision milling requirements, check the HARDINGE Model UM or TM High Speed Precision Milling Machine. Write for descriptive Bulletin.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE
HARDINGE ELMIRA, N.Y.

HARDINGE BROTHERS INC., ELMIRA, N. Y.

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette St., New York 12, N. Y.

What do you think?

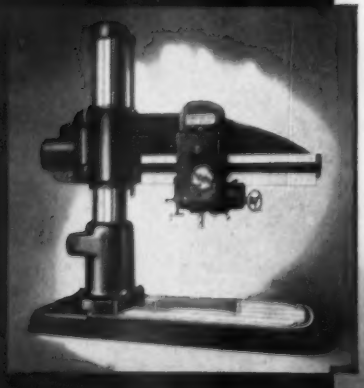
This standard 32-speed "AMERICAN" Hole Wizard Radial Drill head, in combination with a special drilling machine, has just completed the machining of 175,000 work pieces. The operations consisted of 6" diameter spot facing, drilling 5 holes ranging from 1.45" to 5" in diameter, step boring 3 holes ranging from 2.25" to 5" in diameter, two recessing operations and tapping 2.25" diameter holes.

In completing this job the tapping attachment frictions were engaged and disengaged well in excess of 1,000,000 times.

This entire operation was completed without one minute's down time and without maintenance or repair.

Although we have no data to substantiate this, we believe this *must* be some sort of a performance record.

What do you think? . . .



This is exactly the same type of head you get when you install a 32-speed "AMERICAN" Hole Wizard. What better guarantee of service could one ask than this performance record? This is the kind of service that has built "AMERICAN" prestige and preference and accounts for its world-wide reputation for top quality.

The many reasons contributing to "AMERICAN" Hole Wizard predominance are clearly illustrated and described by bulletin No. 327. May we send you one?

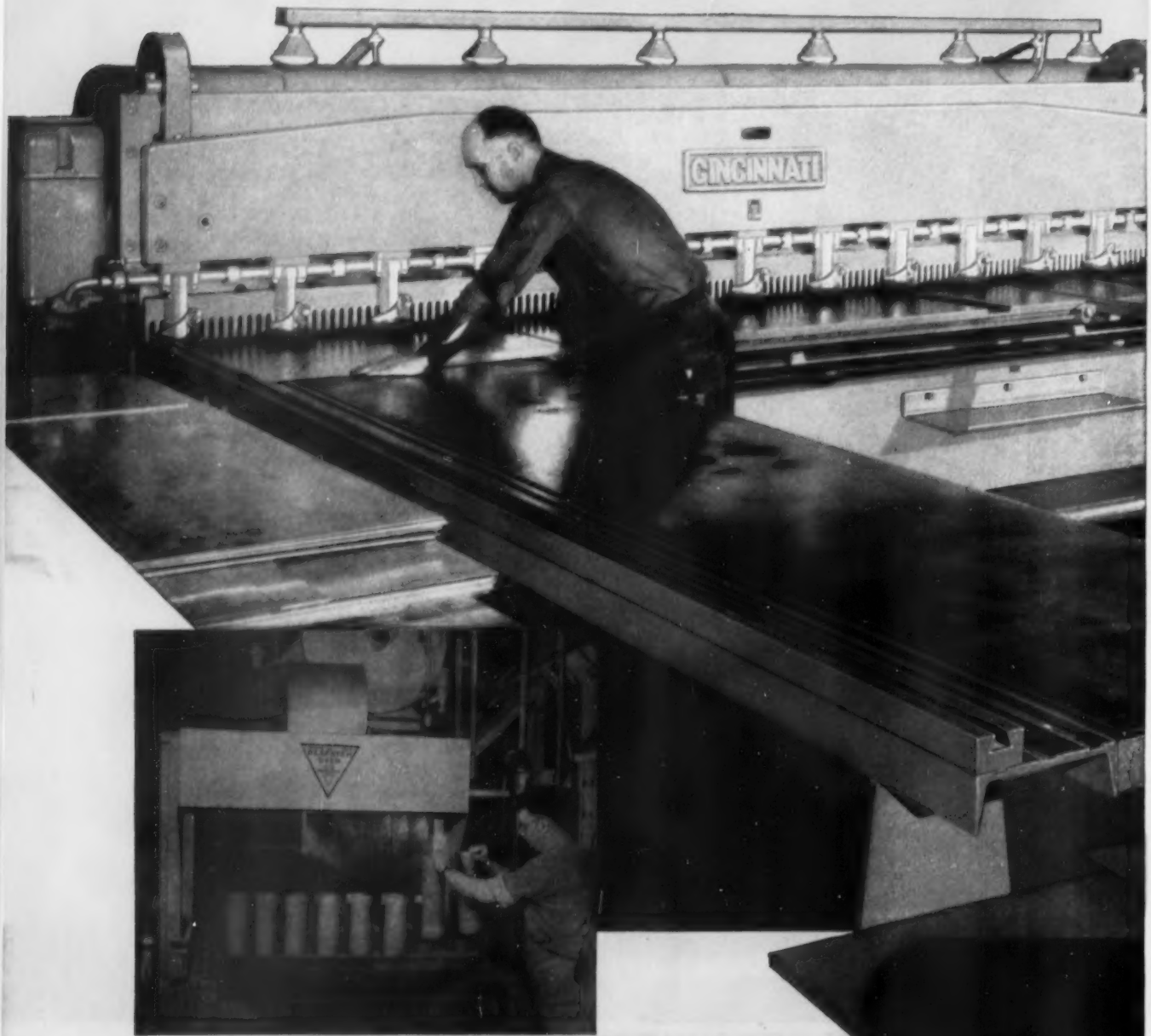
THE AMERICAN TOOL WORKS CO. **Cincinnati 2, Ohio, U. S. A.**

LATHES • RADIAL DRILLS

Cincinnati Shear's

and ACCURATE

Photos courtesy Despatch Oven Company, Minneapolis, Minnesota.



New front controlled power back gauges are now standard equipment on ALL CINCINNATI SHEARS.

fast, easy

gauge setting...*SAVES TIME!*

Cincinnati features bring speed and accuracy in turning out panels for industrial ovens at the Despatch Oven Company.

5′ x 10′ sheets are trimmed four sides—corners are square, sides are clean and straight and panels are sheared accurately to size.

Cincinnati quick, convenient and positive gauging, accurate knife alignment and powerful hydraulic hold-downs speed performance.

Despatch Oven Company say—"This shear has brought an operating time saving, reduced time for maintenance. Performance very good."

Write for Shear Catalog S-7.
If you shear we can help you.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

SPRING STEEL RING

9" O.D. x 6¼" I.D. x .091" 50 pieces (100 surfaces) per hr.; .004" stock per side; limits ±.0005"

CAST IRON END PLATES

30 pieces (60 surfaces) per hour; ⅛" stock removed each side; limits ± .002"

ADJUSTING SCREW WASHERS

Low carbon steel; 200 pieces (200 surfaces) per hour; .025" stock removed; limits ± .001"

HOT ROLLED STEEL CAMS

225 pieces (450 surfaces) per hour; 1/32" stock removed each side; limits ± .001"

NOW! BLANCHARD PRESENTS ANOTHER GREAT NEW GRINDER

with Automatic Cycle Control

This great new Blanchard Surface Grinder performs a variety of jobs with speed, ease and accuracy.

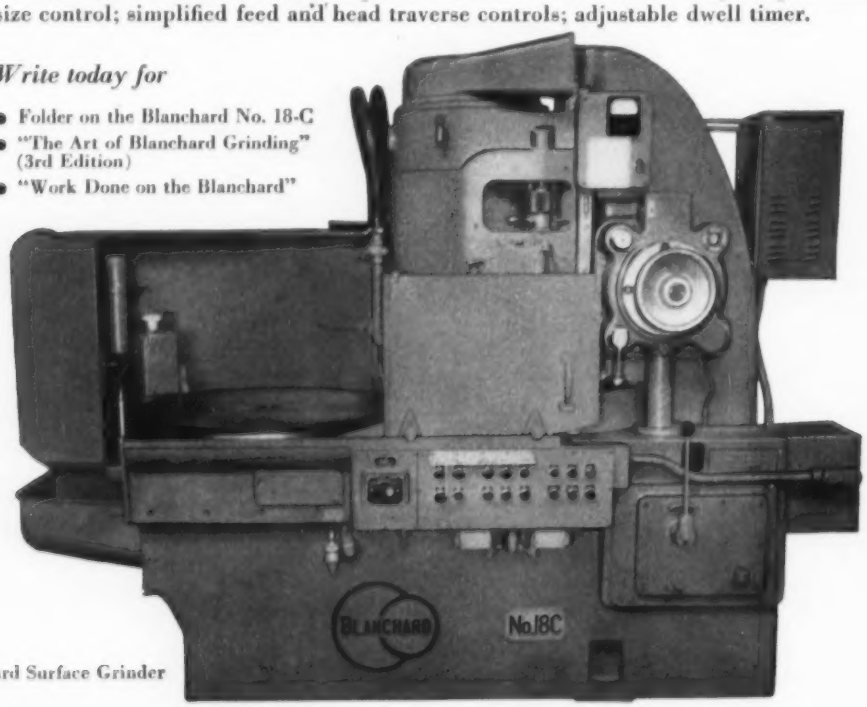
One operator can easily operate two of these No. 18-C grinders under balanced conditions. By using the automatic cycle, he can unload, clean and reload one grinder while the other is grinding.

Here's what the automatic cycle does: moves chuck (30" or 36" dia.) to grinding position and starts it rotating; starts wheel rotation and coolant pump; provides rapid wheel approach to work; engages power down-feed at preset rate; changes to fine feed just before finished size is reached; stops feed when work is to size – "sparks" out; raises wheel head; stops wheel, coolant pump and chuck; moves chuck to loading position – demagnetizes chuck.

This new Blanchard also features: push button selection of manual or cycle operation; size control; simplified feed and head traverse controls; adjustable dwell timer.

Write today for

- Folder on the Blanchard No. 18-C
- "The Art of Blanchard Grinding" (3rd Edition)
- "Work Done on the Blanchard"



No. 18-C Blanchard Surface Grinder

THE BLANCHARD MACHINE COMPANY 64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

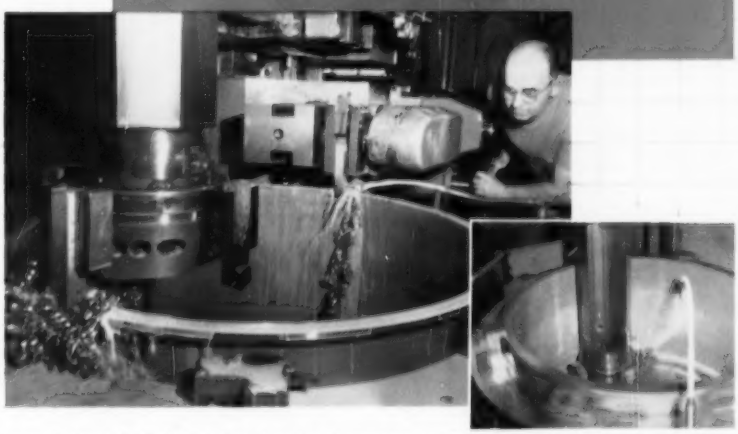
PRODUCTION "at all time Peak"

with BULLARD

MAN-AU-TROL VERTICAL TURRET LATHE

MODEL 75

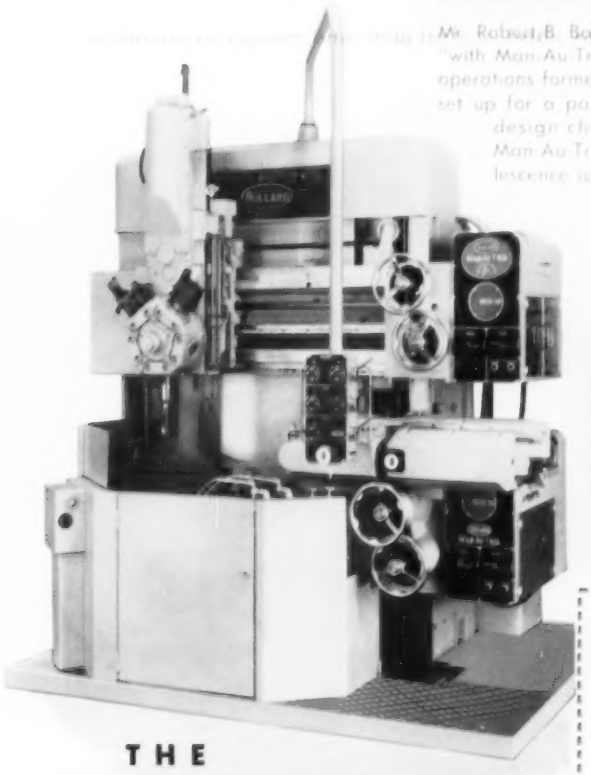
Solar Aircraft Company of Des Moines, Iowa and San Diego, California, has found the versatility and flexibility of the Bullard Man-Au-Trol V.T.L., Model 75 a distinct advantage in the machining and fabricating of various jet aircraft engine parts and assemblies.

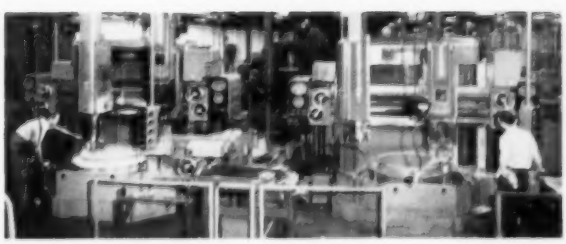


Mr. Robert B. Ballard, Production Manager at Solar-Des Moines, reports that "with Man-Au-Trol, Model 75, it is possible to do a multitude of machining operations formerly requiring numerous expensive machines which had to be set up for a particular operation, so limited in scope, that an engineering design change either obsoleted the tooling or the machine. With Man-Au-Trol, Model 75, because of its wide range of functions, this obsolescence is greatly reduced — if there is a design change, only a new set-up is made — not the purchase of a new multi-thousand dollar piece of machinery."

These same advantages can be applied to your manufacturing methods.

Ask your Bullard Sales Engineer for complete details.





THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

THE BULLARD COMPANY
286 CANFIELD AVENUE • BRIDGEPORT 9, CONNECTICUT

Please send me a copy of the
NEW MAN-AU-TROL V.T.L., MODEL 75 CATALOG

NAME

COMPANY POSITION

ADDRESS

CITY ZONE STATE

ACCO Registered* Wire Rope Slings

Only Cable Laid Slings Give You This Flexibility

• Cable Laid Slings are really different. These specialized slings combine the flexibility of manila rope with the strength of steel. And to this extreme flexibility they add freedom from crankiness and resistance to kinking. The result is a sling which handles easier—saves time—cuts operating costs.

The secret of cable laid slings is in the construction of the wire rope. It is a combination of six individual wire ropes, not strands, laid around a special steel center. These ropes are coated with a special GALACCO coating for maximum corrosion resistance. And ACCO's patented DUALOC endings give extra strength and safety to the finished sling.

SAFEST SLINGS MADE. ACCO cable laid slings, like all of the other slings in ACCO's complete selection, are registered—incorporate extra safeguards, which make them the safest slings made.

Each individual component, made from the highest quality material suited to its use, is tested before assembly—must prove to have strength equal to or greater than the sling body. These components are then assembled into slings according to precisely-engineered designs which have proven their safety and reliability in extensive field tests.

Each completed sling is then proof-tested at twice the load-carrying capacity for which it is rated. Then, and only then, does it receive the coveted registration certificate and tag.

Get the details on Cable Laid, or any other ACCO *Registered* Wire Rope Slings, from your distributor—or call the nearest ACCO district branch below.

FREE FOLDER: Write the Wilkes-Barre office for your copy of new folder **DH-532** which gives details on ACCO *Registered* Cable-Laid Slings.

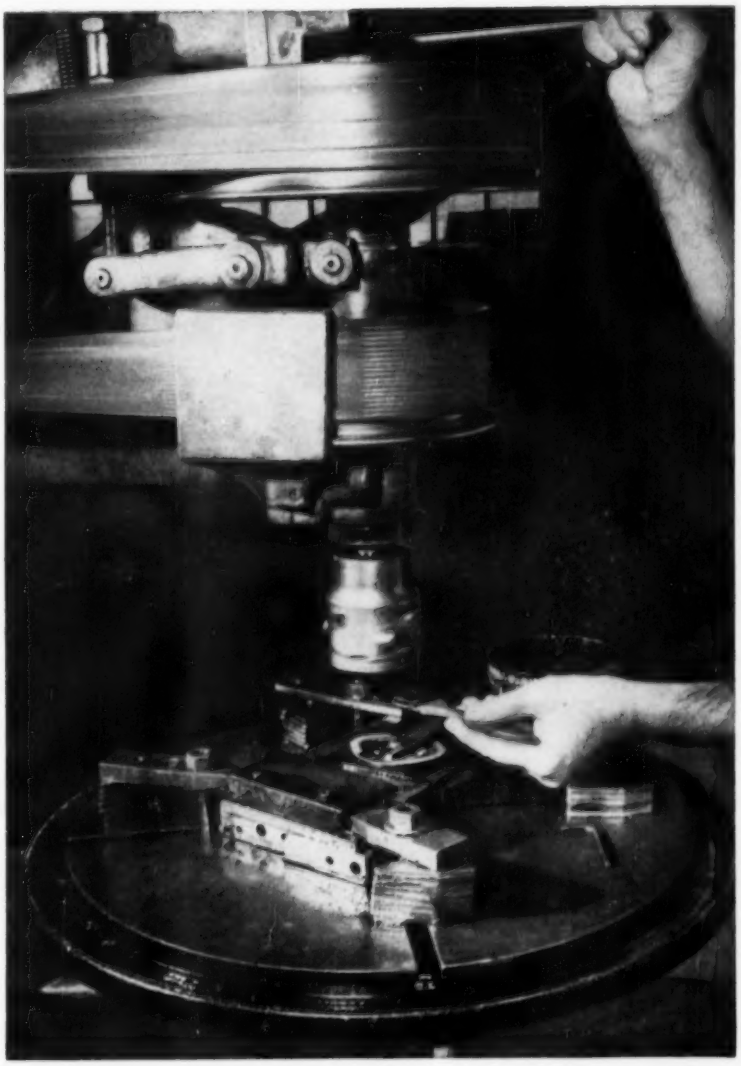
*Trade Mark Registered

ACCO

Wire Rope Sling Department, American Chain & Cable Company, Inc.

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn. In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

"INCREASED TAP LIFE FROM 250 TO 4000 PIECES"



Cities Service Chillo Cutting Oil produces astounding results for C.S.S. Machine & Tool Company, Philadelphia, Pa.

Metal stamping . . . precision grinding . . . machining . . . stud welding . . . tool and die making. These are some of the expert operations performed by the 120 skilled employees of C.S.S. Machine & Tool Company of Philadelphia . . . operations based on many years' knowhow and teamwork. And for the past year, with Cities Service cutting fluids, this work has been done with even greater precision, greater efficiency than ever before.

In its tapping operation, for example, C.S.S. increased tap life from an average 250 pieces to over 4000 pieces with Cities Service Chillo Cutting Oil. And in a drilling operation with its Brown and Sharpe Automatics, time required to make one piece was cut from 240 to 165 seconds!

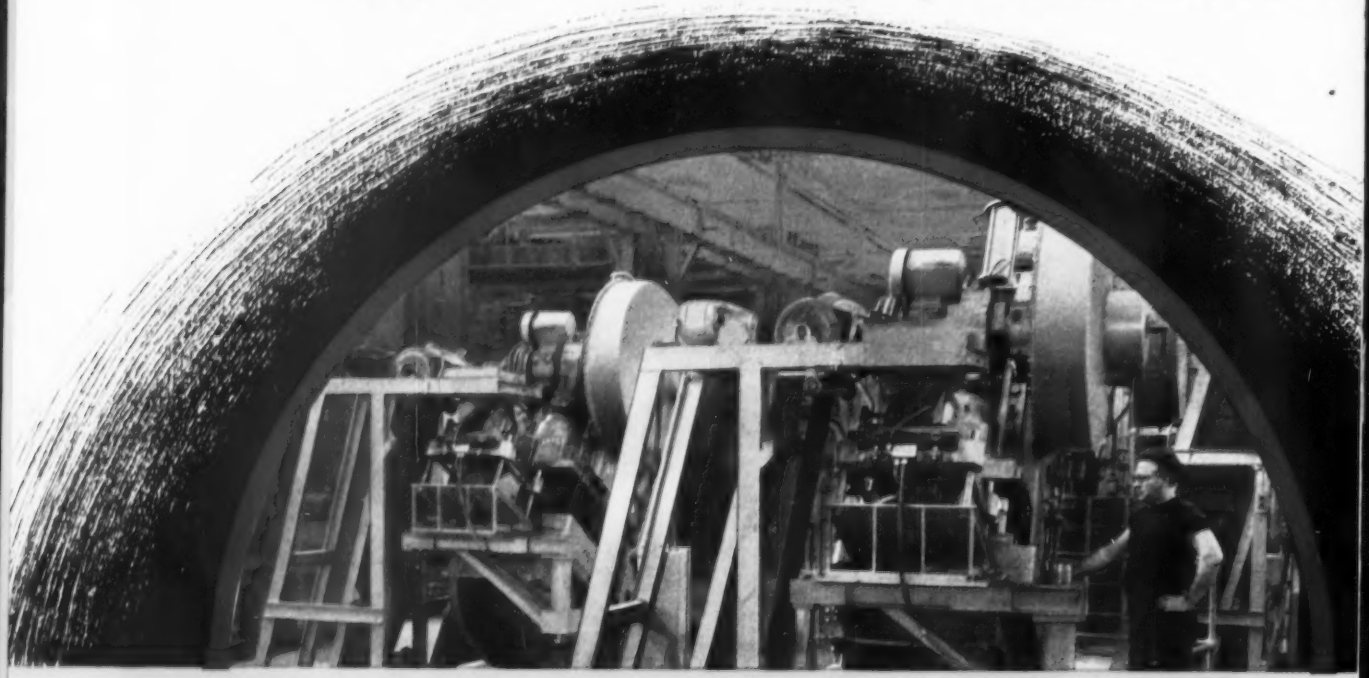
Says President F. G. Schutz: "Cities Service Chillo Cutting Oils are the best we've ever seen. Likewise, Cities Service Lubrication Engineers. It's wonderful to deal with someone who knows our operation so well and has products that help improve it."

If you have a lubrication problem, or even if you're running smoothly, talk with a Cities Service Lubrication Engineer. He's known for solving problems, known for making smooth operations still smoother. Or, if you prefer, write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

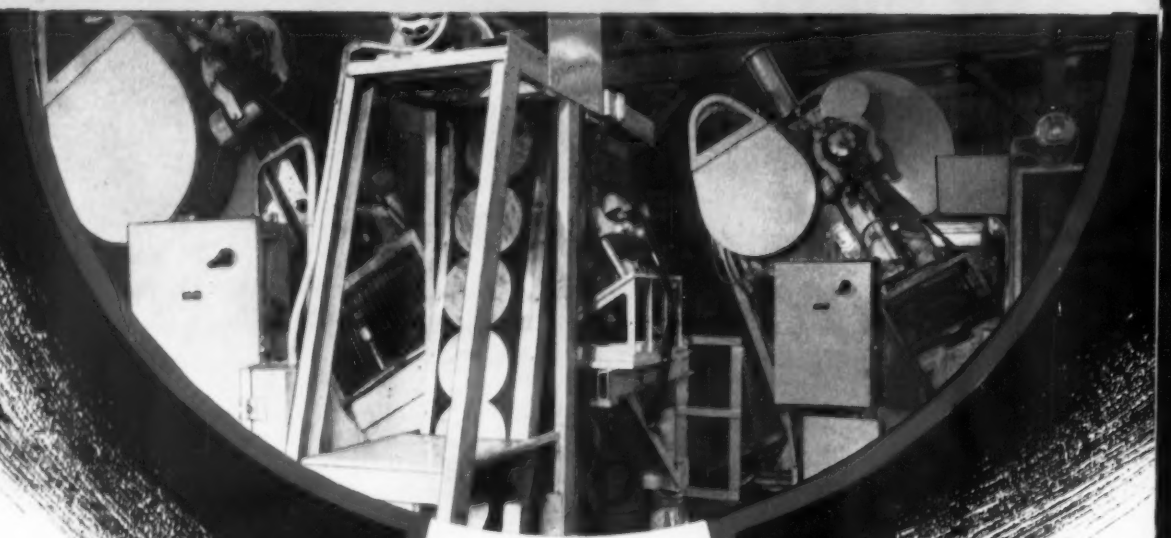
CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

keyhole view of key operations in . . . . .

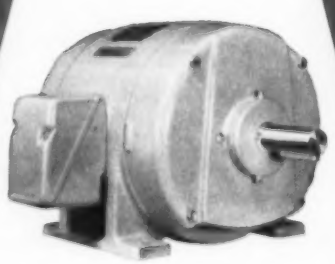


4 NIAGARA AUTOMATIC OBI's PUNCH OUT



(Upper)
Two Niagara OBI's operate on each of the two G-E automated production lines at Building 85.

(Lower)
Fully automatic, 4 Niagara OBI's are fed by magnetized conveyor belts. Stator punchings leave press on upper conveyor and rotor punchings on lower, at rear of press. Scrap is discharged to under-floor conveyors.



Tri-Clad® '55' Motors such as this are manufactured in Building 85.

GENERAL ELECTRIC'S "SUPER SECRET" BLDG. 85 WHICH CUT MOTOR PRODUCTION TIME FROM 2 WKS. TO 24 HRS.

Strictly "hush-hush" for its first year and a half of operation, General Electric's now widely publicized Building 85 in Schenectady gives the rest of the metalworking industry plenty of food for thought.

Chopping down production time of 7½ - 30 hp induction motors, from 2 weeks to 24 hours, is no mean feat. G.E.'s medium induction motor department has done it with the very latest ideas in mechanized fabrication.

Helping to perform the important job of punching out lamination blanks for stators and rotors are 4 fully automatic Niagara OBI Presses. Each is equipped with General Electric ACA adjustable speed drives for maintaining flexibility in the flow of parts to meet market demands for 100 standard motor models . . . the very feature that Building 85 is famous for: *Variety and Automation, too!*

Fitting perfectly into the scheme of things at this, the most modern of electric motor plants, Niagara OBI's operate on fully automatic cycles. Automatically fed by magnetized conveyor belts, they likewise discharge their work automatically to the next operation. Metal waste is removed by under-floor conveyors.

Tough assignment for an OBI? Not for a Niagara! On last report, G.E. was getting 100,000 punchings per press from each set of dies

ROTOR AND STATOR LAMINATION BLANKS

between re-grinds. Longer die life is one of the assured benefits from the rugged, rigid, all-welded steel Niagara frames.

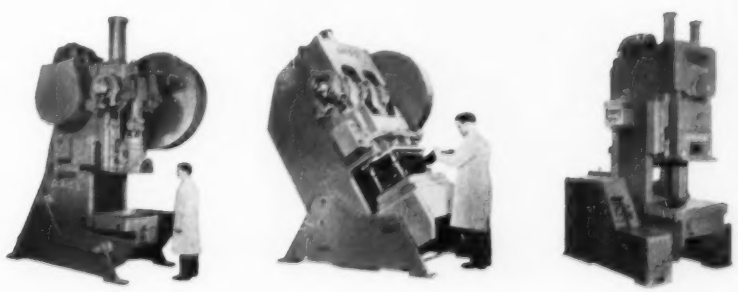
Pacemaker of the press industry, Niagara has the most to offer in OBI's . . . whether it's the Single Crank Electro-Pneumatic Clutch type used in this G-E plant, the Double Crank type for long die area work or the revolutionary new Front-to-Back Crankshaft design in automated or standard models. Now that you have the G-E story, get the whole Niagara story, too. Request literature.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

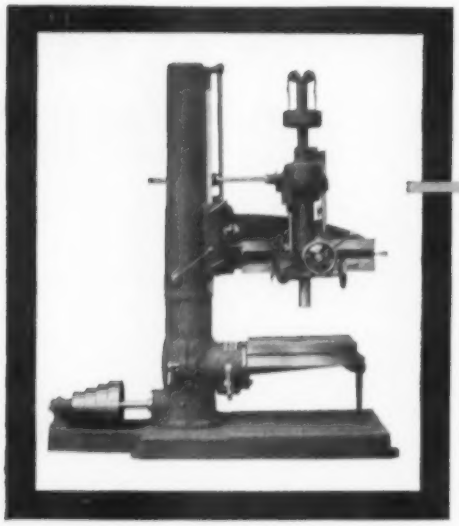
DISTRICT OFFICES: Buffalo • Cleveland • Detroit • New York • Philadelphia

Dealers in principal U. S. cities and major foreign countries

NIAGARA OBI PRESSES



are manufactured in Building 85.



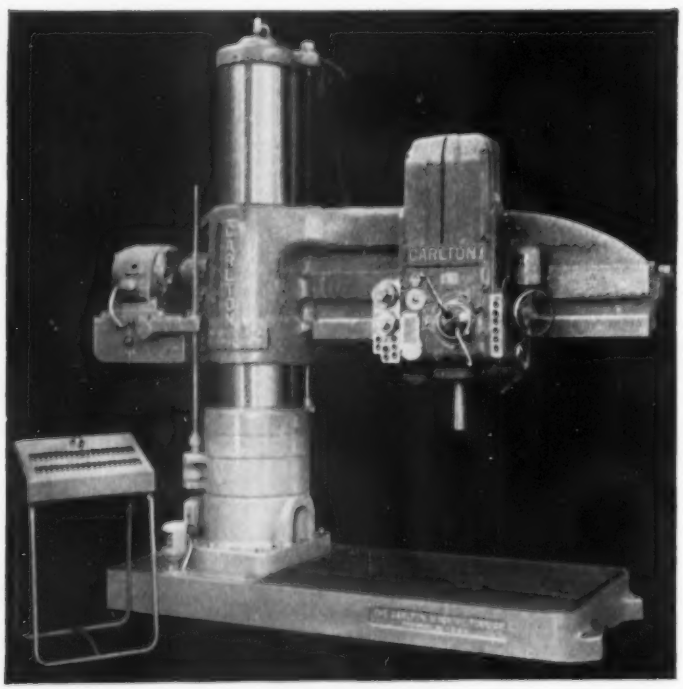
CARLTON	1916 Style D	1956 Model 4A
Speeds, number	4	36
Speeds, maximum, rpm	450	2000
Feeds, number	1	18
Main drive motor, hp	line shaft	25
Bearings, type	plain	anti-friction
Lubrication	manual	automatic
Spindle diameter at point of drive	1 5/16"	4"
Vertical travel of spindle	8"	20"
Traverse of head on arm	40"	59"
Traverse of arm on column	32"	44"
Shipping weight, lbs.	3000	26,335

Carlton RADIAL DRILLS

continuously improved since 1916 . . .

better than ever today . . . now available with

pre-selector and programming device



The belt driven Style D Carlton radial drill (above)—an advanced design model when introduced in 1916—looks pretty old-fashioned today.

And indeed it is. For Carlton radial drills today are ever so much faster and more powerful. And thanks to two sensational developments, Carlton radial drills are now better than ever:

Programming—for pre-selecting speeds and feeds for an entire drilling program including as many as 20 or 30 operations.

Pre-Selector—for setting speed and feed for the next operation while machine is still under cut.

For a revealing radial drill demonstration, ask your Carlton distributor to arrange a showing of the new Carlton programming film. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Perfect! but only half the story

These ring gages are saving this plant a lot of money right now on this two step threading job. But, even the best of gages will show wear in time. Only frequent checking will save them from eventually passing oversize products.

The answer, of course, is setting plugs. When ordering ring thread gages, always order corresponding setting plugs. If you have suitable setting plugs send them to "Greenfield" and the new rings will be set to them, and sealed if requested.

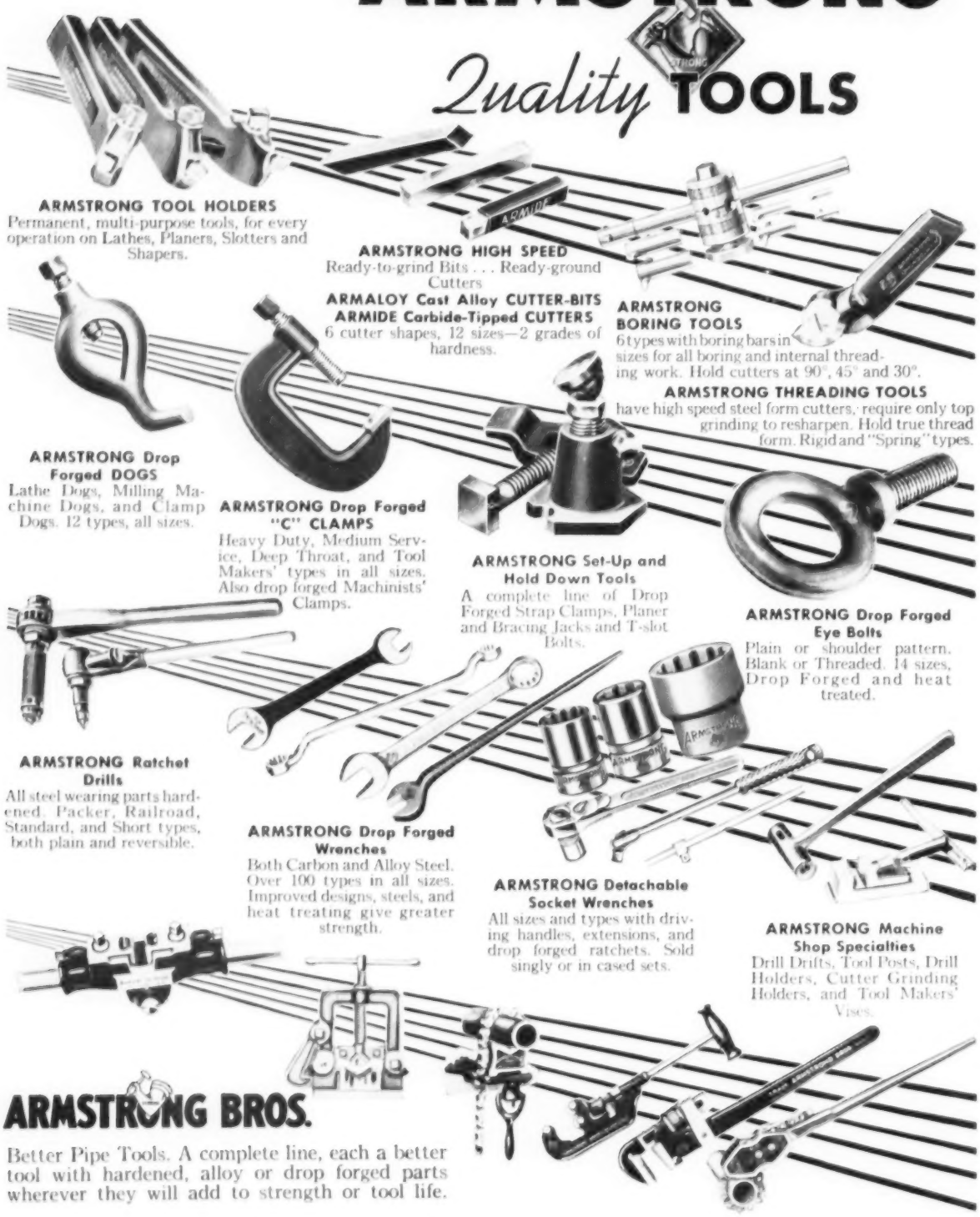
Naturally, setting plugs are never seen around a job. They are safe in tool storage marked, "use only for setting rings".

And that is the other half of the story.

GREENFIELD TAP and DIE CORP.
GREENFIELD, MASS.

ARMSTRONG

Quality TOOLS



ARMSTRONG TOOL HOLDERS
Permanent, multi-purpose tools, for every operation on Lathes, Planers, Slotters and Shapers.

ARMSTRONG HIGH SPEED
Ready-to-grind Bits . . . Ready-ground Cutters

ARMALOY Cast Alloy CUTTER-BITS
ARMIDE Carbide-Tipped CUTTERS
6 cutter shapes, 12 sizes—2 grades of hardness.

ARMSTRONG BORING TOOLS
6 types with boring bars in sizes for all boring and internal threading work. Hold cutters at 90°, 45° and 30°.

ARMSTRONG THREADING TOOLS
have high speed steel form cutters, require only top grinding to resharpen. Hold true thread form. Rigid and "Spring" types.

ARMSTRONG Drop Forged DOGS
Lathe Dogs, Milling Machine Dogs, and Clamp Dogs. 12 types, all sizes.

ARMSTRONG Drop Forged "C" CLAMPS
Heavy Duty, Medium Service, Deep Throat, and Tool Makers' types in all sizes. Also drop forged Machinists' Clamps.

ARMSTRONG Set-Up and Hold Down Tools
A complete line of Drop Forged Strap Clamps, Planer and Bracing Jacks and T-slot Bolts.

ARMSTRONG Drop Forged Eye Bolts
Plain or shoulder pattern. Blank or Threaded. 14 sizes. Drop Forged and heat treated.

ARMSTRONG Ratchet Drills
All steel wearing parts hardened. Packer, Railroad, Standard, and Short types, both plain and reversible.

ARMSTRONG Drop Forged Wrenches
Both Carbon and Alloy Steel. Over 100 types in all sizes. Improved designs, steels, and heat treating give greater strength.

ARMSTRONG Detachable Socket Wrenches
All sizes and types with driving handles, extensions, and drop forged ratchets. Sold singly or in cased sets.

ARMSTRONG Machine Shop Specialties
Drill Drifts, Tool Posts, Drill Holders, Cutter Grinding Holders, and Tool Makers' Vises.

ARMSTRONG BROS.

Better Pipe Tools. A complete line, each a better tool with hardened, alloy or drop forged parts wherever they will add to strength or tool life.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**

No. 6 in a series

You send print to Cone

Cone makes recommendations

Cone submits samples of your work

You get demonstration of your work and complete job development record

There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

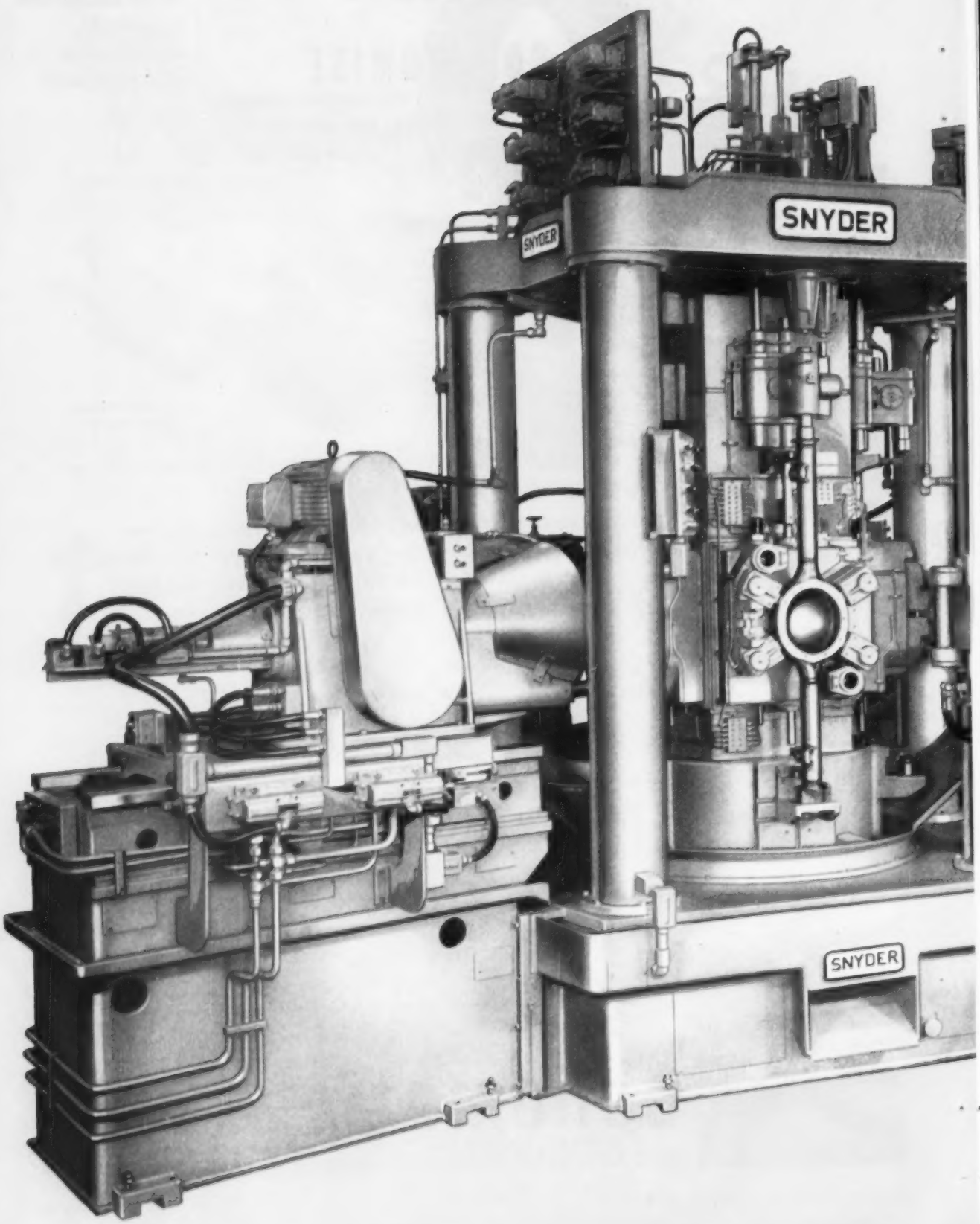
DATA FOR COMPARISON

Part	Bushing	Length	⅝"
Machine	1⅝" Conomatic	Hole Dia.	1¼"
Tools	100% Carbide Tipped	RPM	825
Material	8620	Time	14.8 Secs.
Stock Size	1⅝"		

Conomatic

For particulars send for "Four Steps With Cone"

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.


SNYDER
SNYDER
SNYDER

SNYDER VERTICAL TRUNNION MACHINE

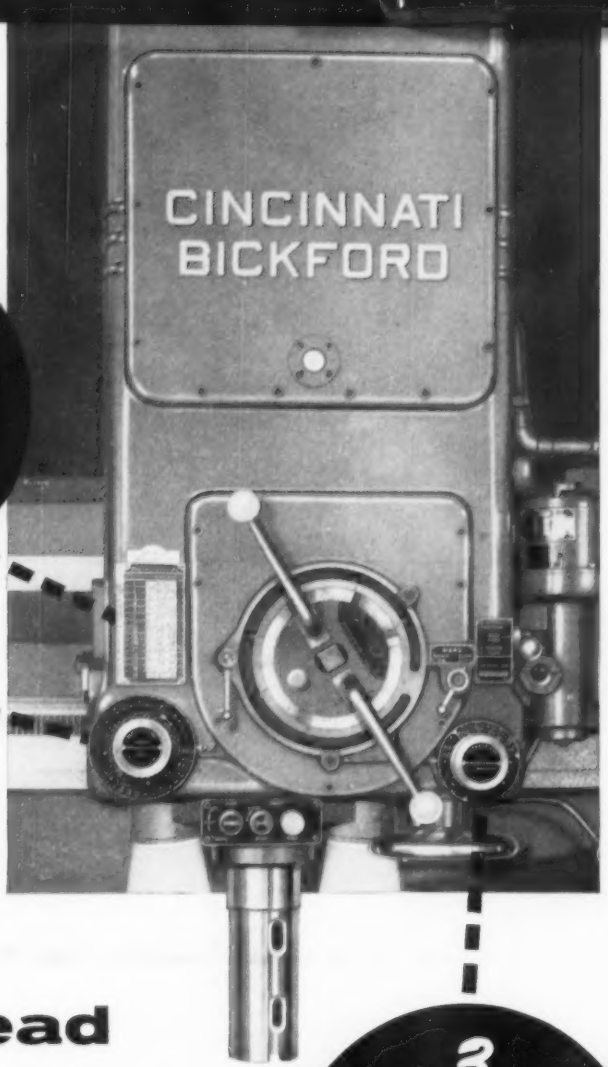
for processing rear axle housing assembly; rough and finish faces banjo face, combination drills and reams ten holes in banjo face and chamfers both sides of holes. Production: 105 pieces an hour at 100% efficiency.

SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

31 Years of Special Machine Tools with Automation



1. The Prescheduling Chart plans the sequence of operations . . . charts the proper speeds and feeds . . . is a permanent record of each tool diameter, speed and feed.

2. Speed Dial — Preselects any one of 36 speeds while machine is in operation—shift is automatic at end of each operation.

3. Feed Dial—Preselects any one of 18 feeds for next tool while machine is in operation — shifting is quiet and direct.

The HEAD that's way ahead

. . . brings you 3 outstanding performance features!

The concentration of complete control of all speeds and feeds by two easily read dials on the head is an outstanding advance in design.

Saves time — insures controlled correct operation — and is easy for the operator.

Hydraulic shift for speeds and feeds is quiet and positive. All mechanism for preselection is contained in the head. These ultra modern Super Service Radials have many other advanced features — for easy handling and high productivity.

Write for Bulletin R-33. You will be interested in the many new features.

CINCINNATI BICKFORD

SUPER C B SERVICE

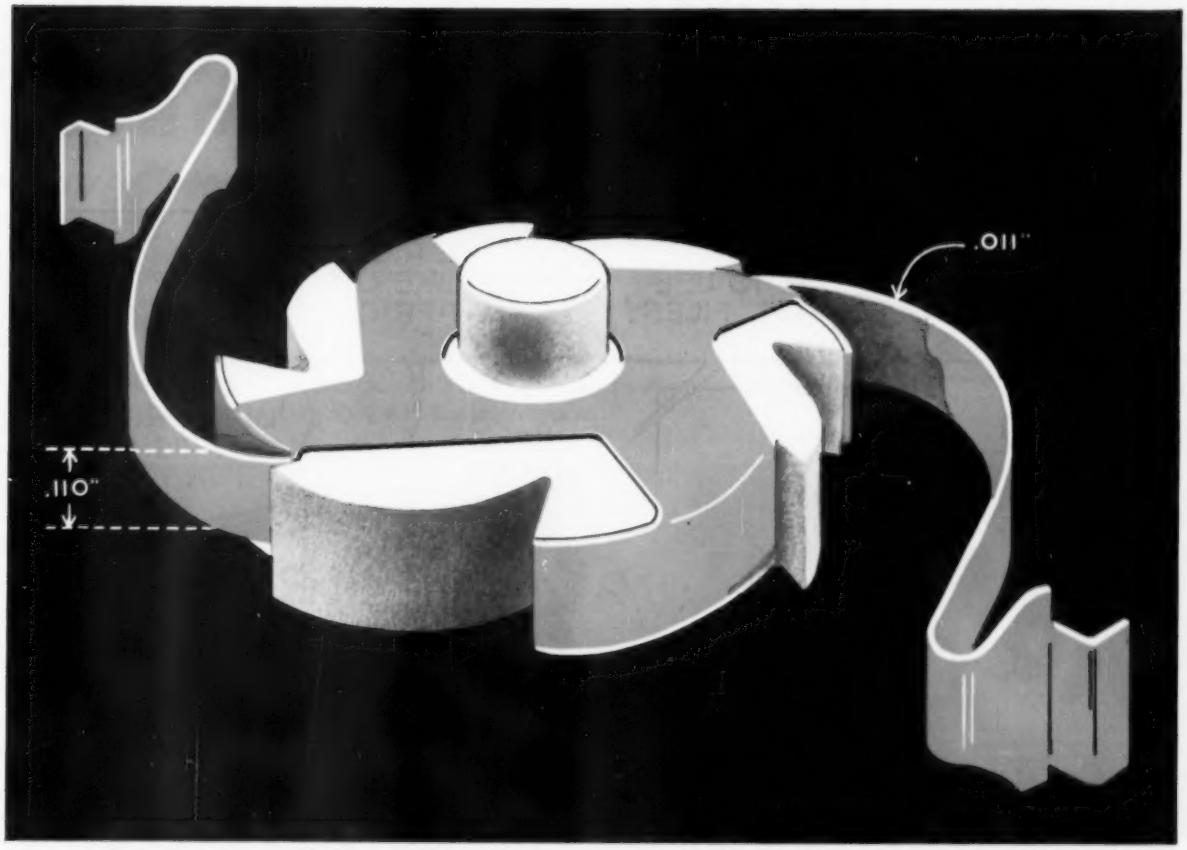
G&L

RADIAL AND UPRIGHT DRILLING MACHINES

CINCINNATI BICKFORD DIVISION

GIDDINGS & LEWIS MACHINE TOOL COMPANY

OAKLEY, CINCINNATI 9, OHIO, U.S.A.



Enlargement showing the contact springs at the "heart" of one model of the Levolier® switch mechanism. Levolier switches are used in industrial and commercial lighting, in heavy-duty industrial sockets, in appliances, fixtures, etc.

The Anaconda alloy tailored for this punishing service actually costs less

Cutaway of Levolier Switch No. 41 shown approximately actual size.

THE PROBLEM: The McGill Manufacturing Company, Inc., Valparaiso, Indiana, was interested in a desirable substitute for a premium copper alloy used in contact springs for their widely known Levolier switch mechanisms. Unexcelled quality had to be maintained with a new alloy that would help hold prices against rising costs. As these switches are designed for long service and heavy-duty industrial service, the spring material has to be tough and durable.

THE SOLUTION: In 1952, McGill discussed the problem of an alternate spring material with a metallurgical engineer from The American Brass Company. After an analysis of the requirements, a special Anaconda alloy was offered—Ambronze-422, rolled to spring temper.

Samples were prepared and tested by McGill and Underwriters' Laboratories. The material performed satisfactorily in standard tests—current carrying capacity, 6 amps at 125 volts d.c.—readily exceeded the requirements of 75,000 cycles, or 150,000 individual operations.

In production, the new Anaconda alloy also performed satisfactorily. It was necessary to make only one minor die-forming change. McGill received a desirable saving in material costs—product quality remained high—and the material was available as needed to maintain production.

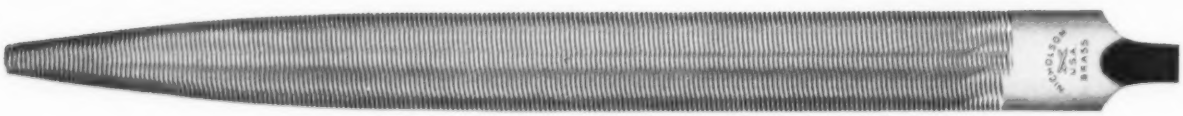
FREE TECHNICAL SERVICE: This is another example of the Anaconda technical service available to metal users. Sometimes a new alloy is required—other times a variation of a standard alloy will do the job. The Technical Department of The American Brass Company, through its day-to-day work with a wide variety of metal problems, offers a tremendous breadth of experience, which is at your disposal. See your American Brass Company representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

ANACONDA® COPPER AND COPPER ALLOYS

OAKLEY, CINCINNATI 9, OHIO, U.S.A.

POP'S school of Filing

POP TOL' TH' NEW GUY TO USE "SPECIALIST" FILES!
SO HE RIGS HISSELF OUT LIKE ONE A THEM HIGH-PRICED MEDICS!
POP'LL TEACH 'IM TO PRESCRIBE TH' RIGHT FILES FOR TH' JOB!



The Right File for the Job pays off in faster cutting, longer wear and better, smoother work. There are Nicholson Special Purpose files for Aluminum, Brass, Lead, Stainless Steel and other hard-to-work materials, for Foundry and Die Casting work, plus Swiss Patterns in hundreds of shapes and sizes.

These are "specialist" files. And they're made by a "specialist" company. Nicholson File Company has been making files—and nothing but files—for more than 92 years. Carefully. Conscientiously. With unremitting research and development to keep pace with the filing requirements of industry.

Most of "Pop's" knowledge of file care, selection and use is in the 49-page "textbook," *File Filosophy*. It may pay you to write for your *FREE* copy today.

NICHOLSON U.S.A.

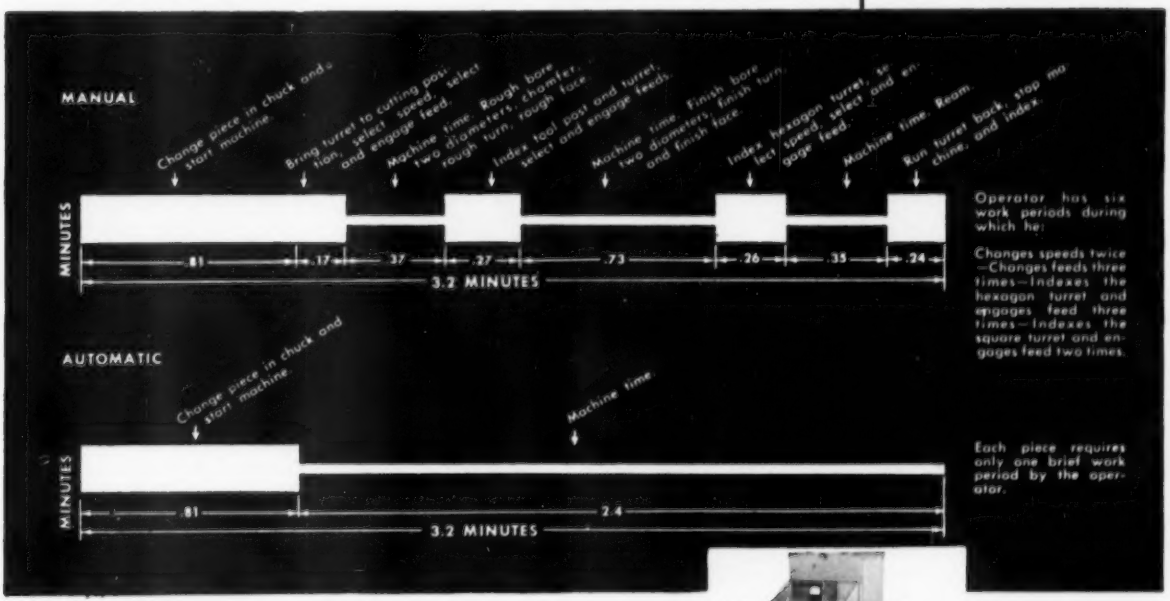
NICHOLSON FILE COMPANY, PROVIDENCE, RHODE ISLAND
(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

BLACK DIAMOND U.S.A.

NICHOLSON FILES *A FILE FOR EVERY PURPOSE*

how the GISHOLT FASTERMATIC saves man-minutes and money!

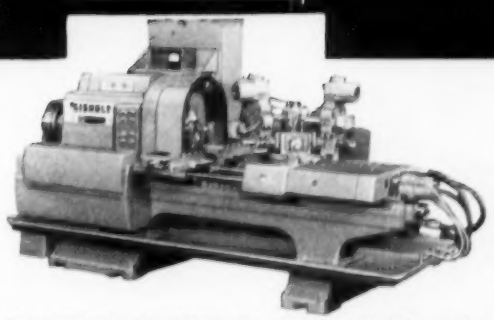
Here is an actual comparison of the time and work cycle of a manually operated turret lathe and a Gisholt Fastermatic Automatic Turret Lathe. The machining of wheel hubs, shown above, requires 6 operations as follows: rough bore, finish bore, ream, rough face, finish face and chamfer. Note that the manually operated machine takes over 54% of the operator's time whereas the Fastermatic takes only 25% of his time, leaving 75% without interruption.


MANUAL
Change piece in chuck and start machine.
Bring turret to cutting position, select speed, and engage feed, select
Machine time. Rough bore two diameters, chamfer, rough turn, rough face
Index tool post and turret, select and engage feeds.
Machine time. Finish bore two diameters, finish turn and finish face.
Index hexagon turret, select speed, select and engage feed.
Machine time. Ream.
Run turret back, stop machine, and index.
MINUTES
.81
.17
.37
.27
.73
.26
.35
.24
3.2 MINUTES
Operator has six work periods during which he:
Changes speeds twice—Changes feeds three times—Indexes the hexagon turret and engages feed three times—Indexes the square turret and engages feed two times.
AUTOMATIC
Change piece in chuck and start machine.
Machine time
MINUTES
.81
2.4
3.2 MINUTES
Each piece requires only one brief work period by the operator.

That's the story of the Fastermatic in a nutshell—less work time for the operator. The Fastermatic handles all changes of feeds and speeds automatically.

In this case, for example, the other side of the work piece is done by another Fastermatic with substantially the same cycle. One operator keeps both machines constantly under cut and still has ample time for stacking and work inspection. Important, too, is the fact that both Fastermatics are tended by a comparatively unskilled operator.

There are many such cases where Fastermatics can cut costs substantially. Gisholt engineers will gladly answer your questions. Write us.



THE GISHOLT 1-F FASTERMATIC—*smallest of 3 different sizes which enable you to machine a maximum number of surfaces in one chucking, handling all changes in speed and feed automatically. On this job, turret was double-tooled so that two parts were completed with each revolution of the turret. Ask for literature.*

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

GISHOLT

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface finishing and balancing of round and partly round parts. Your problems are welcomed here.*

DESIGN ENGINEERS

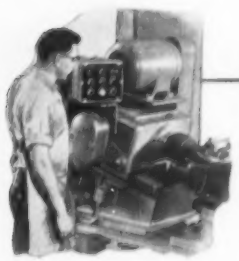
SUNDSTRAND design engineers devote their time to the design and development of basic standard units which can be used in many combinations of either standard or special machines. They are primarily concerned with the functioning of the individual components which go into a machine.

Their design experience is based on many years of development of units for light fast cutting on small parts, heavy cuts on large parts, three dimensional tracing of irregularly shaped work pieces and countless other problems in milling.

Some of the units developed are shown below. From these basic elements it's easy to get what you need from Sundstrand.

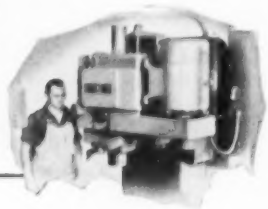
How Two Types of Engineers Serve You With SUNDSTRAND

"Engineered Production"



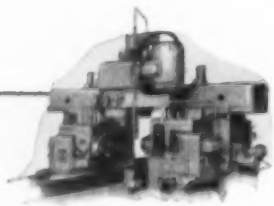
TRAVELING HEADS

Self contained units with ways for horizontal or angular travel.



VERTICAL OR HORIZONTAL HEADS

Available in capacities from 3 to 100 h.p.



RAIL TYPE HEAD

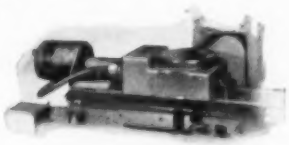
Way type rail provides extreme accuracy over wide range of adjustment for vertical spindle head.

ROTARY TABLES

Available in several sizes for continuous or rotary milling operations.

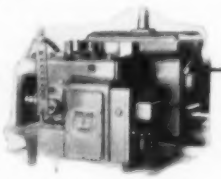
HORIZONTAL TABLES

Available in widths from 10½" to 96" and feed strokes from 18" to 216".



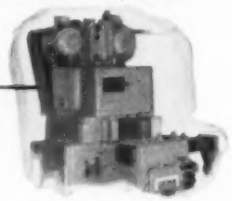
INDEX BASES

Easily applied to standard Rigidmils for increased production by the elimination of loading time or improvement in accuracy by the machining of multiple surfaces with one handling of the work piece.



ADJUSTABLE COLUMNS

Movable columns provide maximum cutting rigidity for horizontal heads over a wider range for milling both large and small work pieces.

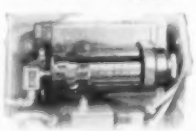


VERTICAL FEED UNIT

This unit provides vertical feed and rapid traverse in combination with the table movement for square cycles, clearing obstructions on work piece, etc.

TRACER MILLING UNIT

Used for 3 dimensional tracer milling of intricate forms.



AUTOMATIC QUILL POSITIONING

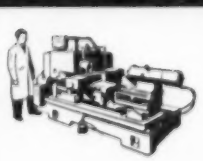
Positions the cutter for multiple depths of cuts and provides automatic cutter relief.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

SUNDSTRAND

*"Engineered Production" Service**

*REG. U.S. PAT. OFF.



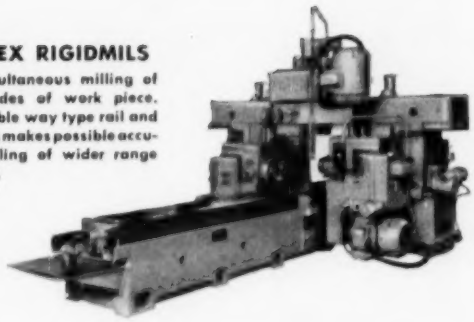
APPLICATION ENGINEERS

In effect, our application engineers increase both the size and experience of your own processing department when you refer your milling problems to Sundstrand. They place at your disposal all the broad background of knowledge accumulated thru many years of finding the best method and then providing the most suitable unit or machine combination to do the job.

Shown below are just a few of the many machine combinations available from Sundstrand units. With this method of machine design and construction it is easy to obtain the proper equipment to suit your work.

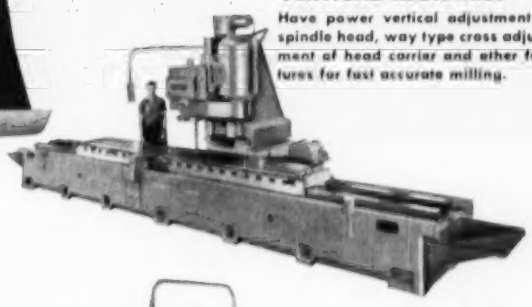
TRIPLEX RIGIDMILS

For simultaneous milling of three sides of work piece. Adjustable way type rail and columns makes possible accurate milling of wider range of work.



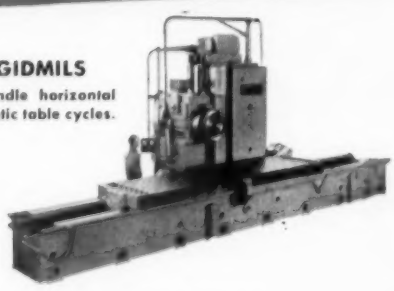
VERTICAL RIGIDMILS

Have power vertical adjustment to spindle head, way type cross adjustment of head carrier and other features for fast accurate milling.



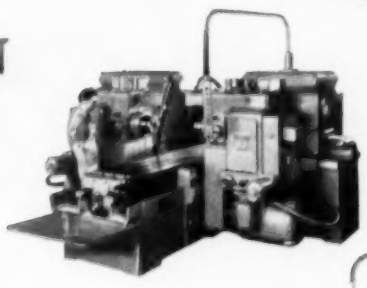
SIMPLEX RIGIDMILS

Have single spindle horizontal head and automatic table cycles.



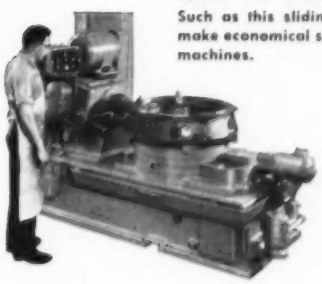
DUPLEX RIGIDMILS

Have two horizontal heads for milling two sides simultaneously. Adjustable column type shown has wider range between spindles.



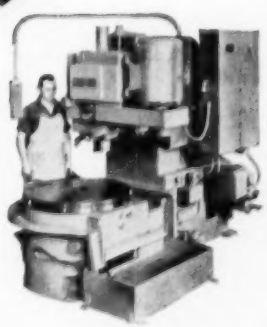
UNIT TYPE RIGIDMILS

Such as this sliding head machine make economical special production machines.



ROTARY RIGIDMILS

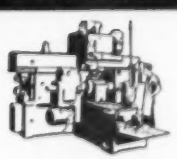
Have vertical spindle head, way type cross adjustment of spindle head carrier and rotary table for continuous or circular milling.



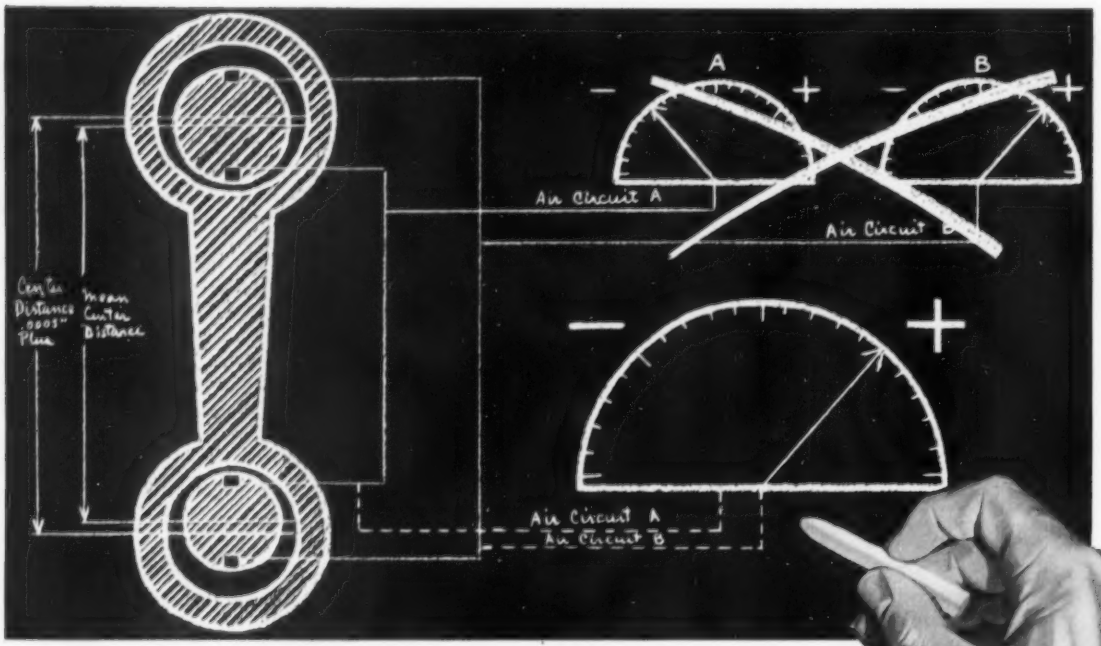
FREE DATA

Get complete facts on the complete line of Sundstrand machine tools and "Engineered Production" service. Write for Bulletin 169.

TRIPLEX RIGIDMILS | **SPECIAL MACHINES**



SUNDSTRAND
Machine Tool Co.
2533 Eleventh St. • Rockford, Ill., U.S.A.



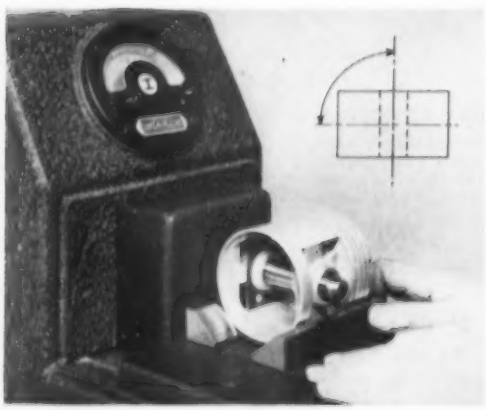
NOW! Gage Center Distance with Just One Dial

...using a Taft-Peirce Comp-U-Tair*

Gage parts twice as fast — and far more easily — with this exclusive T-P *computing* air gage . . . the Comp-U-tair.

Checking a dimensional relationship like center distance, for example, is greatly simplified. The Comp-U-tair measures, computes, and indicates the result on a *single* indicator with *one* pointer. The Comp-U-tair is a *differential air gage*, in which two air circuits are applied to opposing sides of the differential device. Gaging nozzles are placed so that diameter variations cancel each other and have no effect on true center distance reading. Operator reads just one dial, does no calculating, and has an instant, positive indication for every part — in or out of tolerance, plus exact amount and direction of variation.

Streamline your gaging with the unique Comp-U-tair. Call Taft-Peirce to save time and money throughout your inspection operations. As a starter, write for Air Gage Catalog No. 613.



The Comp-U-tair does many other jobs . . .

One big time-saver is measuring squareness, shown above. Squareness is indicated on one *dial* with one *pointer*. The Taft-Peirce Comp-U-tair figures as it measures, can be designed to check several dimensional relationships *simultaneously*. Number of dials is cut in half . . . inspection is faster, more accurate.

*Patent Pending

THE TAFT-PEIRCE FAMILY...

- Magnetic Chucks
- Precision Gages
- Air Gages
- Grinding Machines
- Lapping Machines
- Tool-Room Specialties

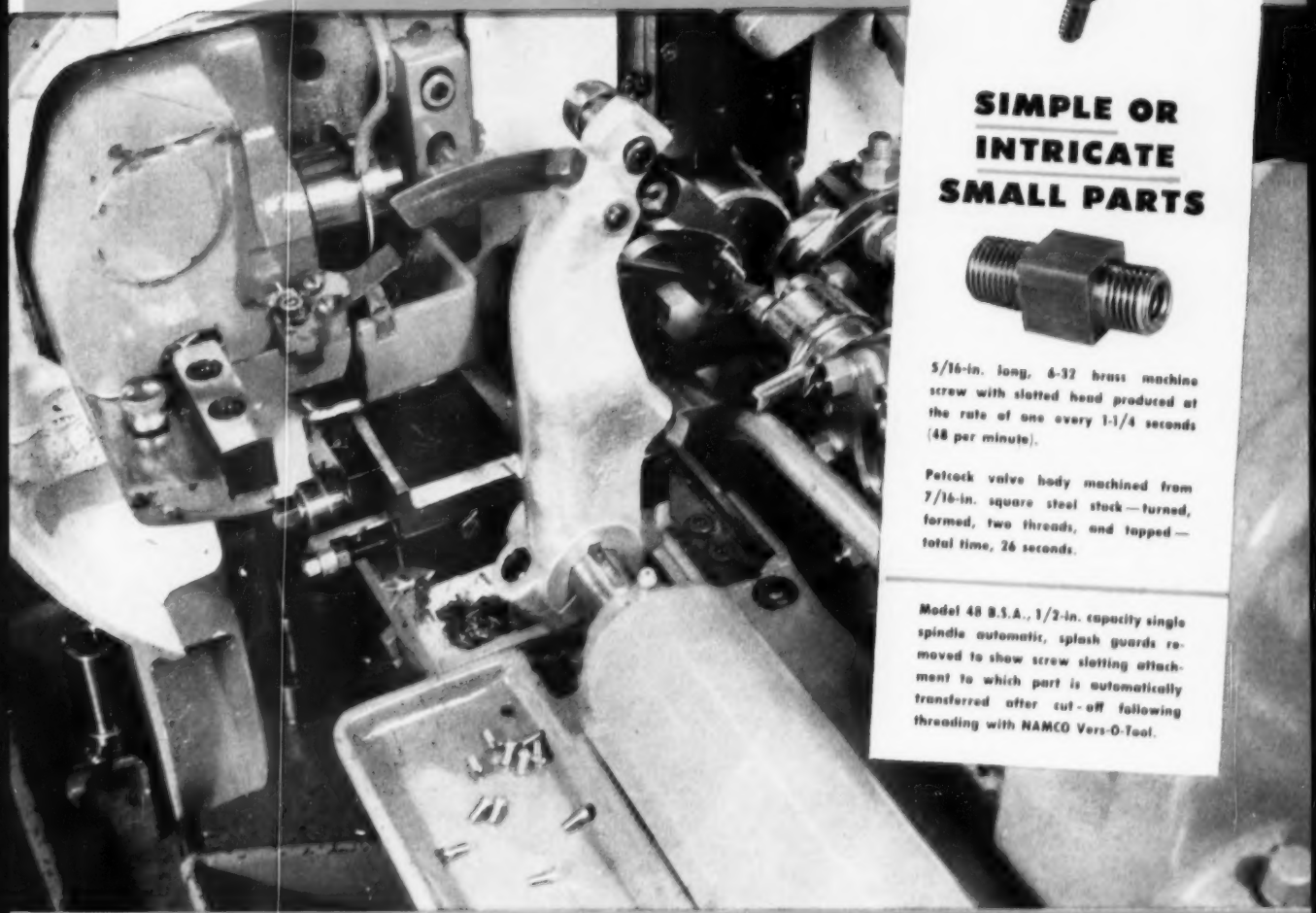
TAKE IT TO TAFT-PEIRCE

TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND

DISTRIBUTED AND SERVICED IN U. S. A. BY

NATIONAL ACME

BSA Single Spindle Automatic SPEEDS PRODUCTION of



SIMPLE OR INTRICATE SMALL PARTS

5/16-in. long, 6-32 brass machine screw with slotted head produced at the rate of one every 1-1/4 seconds (48 per minute).

Petcock valve body machined from 7/16-in. square steel stock—turned, formed, two threads, and tapped—total time, 26 seconds.

Model 48 B.S.A., 1/2-in. capacity single spindle automatic, splash guards removed to show screw slotting attachment to which part is automatically transferred after cut-off following threading with NAMCO Vers-O-Tool.

B.S.A. single spindle automatics are designed for a wide latitude of machining operations with standard attachments. Thus maximum operating flexibility is maintained at all times to insure trouble-free continuous high volume output. Productive capacity includes those parts that require the most intricate automatic machining.

Tools, toolholders, cam blanks and similar equipment for all B.S.A. models are interchangeable with standard American tooling. Special tools and attachments further increase the range of application of these machines.

Built in 5 sizes—rated capacities, 1/2-in. to 2-in.) For general specifications, write for Bulletin B.S.A.-54.

National Acme

THE NATIONAL ACME COMPANY, 171 EAST 131ST STREET, CLEVELAND 8, OHIO

SALES OFFICES: • Newark 2, New Jersey • Chicago 6, Illinois • Detroit 27, Michigan

THREADING COSTS reduced to $0.00003 per piece with new ACME-FETTE Thread Rolling Head. Details on following Page →→→

Acme-FETTE

Cuts threading costs to $0.00003 per piece

On an automotive part that required millions of *duplicate* pieces, one manufacturer found that the application of Acme-Fette thread rolling heads enabled him to:

1. Get required production with 9 Acme-Gridley bar automatics instead of 14.

2. Secure better threading results with rolled threads which provided smoother, tougher threaded pieces.

3. Show a unit threading cost of *3 one-thousandths of a cent.*

4. Reduce total cost per piece more than 33⅓% while producing in excess of 35,000,000 pieces.

Why not check Acme-Fette advantages on your threading jobs?

New Acme-Fette Type N self-opening thread rolling heads are used with either rotating or non-rotating spindles. They let you complete threaded jobs on your present turning equipment without rehandling — roll threads *5 times faster* than thread cutting methods (and with no chip problem).

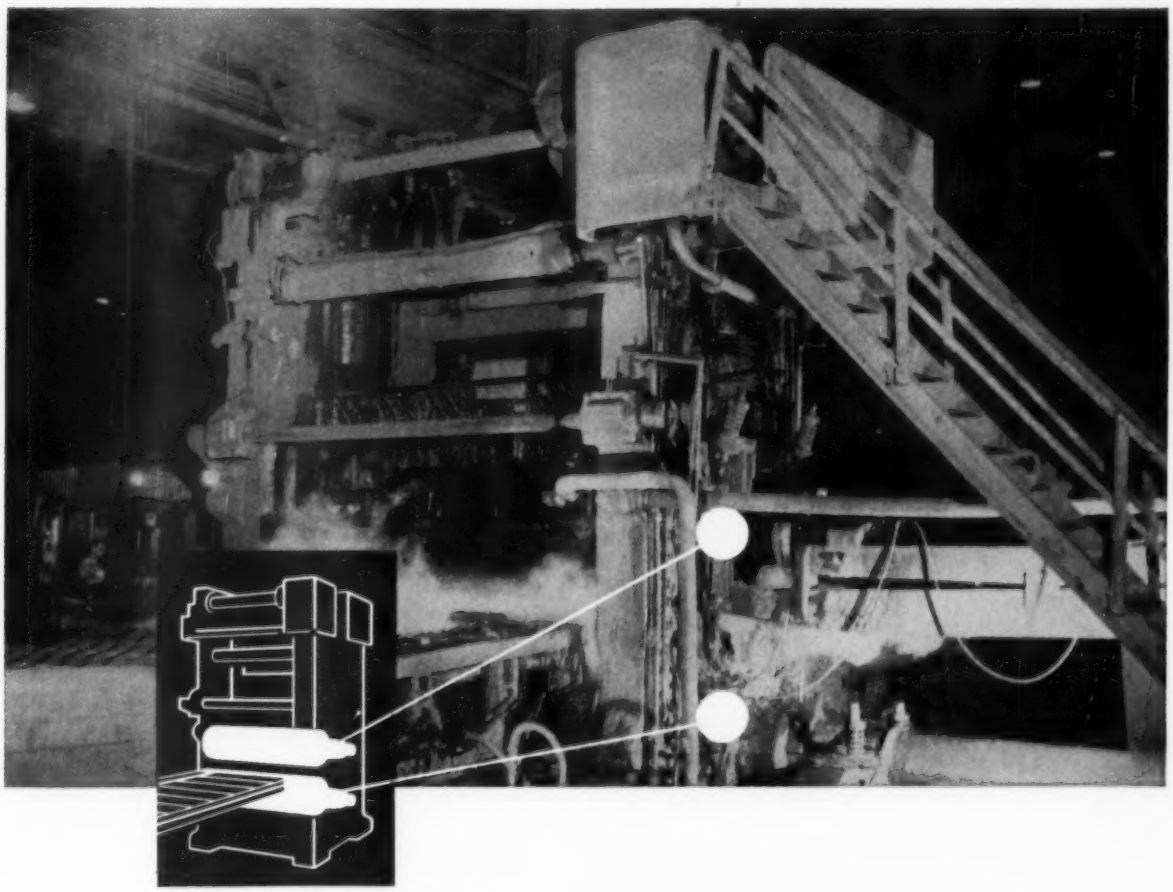
National Acme

THE NATIONAL ACME COMPANY, 171 EAST 131ST STREET, CLEVELAND 8, OHIO

SALES OFFICES: • Newark 2, New Jersey • Chicago 6, Illinois • Detroit 27, Michigan

← ← ← B.S.A. SINGLE SPINDLE AUTOMATICS speed machining of simple or intricate small parts. (See advertisement on preceding page)

Lubricating roll necks is no easy job



Lubricating the roll necks of a steel mill calls for a lubricant that will resist high temperatures. The lubricant must also function in the presence of steam, water, mill scale and other abrasive materials. It has to cushion great shock loads and cling tenaciously to the bearings it protects. It must last a long time . . . and it must be economical in use.

Atlantic Lubricant 10 performs exceptionally well in this service. It is being used in a pressure system on the mill illustrated, at the Lukens Steel Company in Coatesville, Pa., for the lubrication of roll neck bearings, pinion and spindle bearings.

Selecting the correct lubricant for the job is simplified when you call in your Atlantic Lubrication Engineer. He is a man with years of on-the-job knowledge of heavy industrial lubrication requirements of all kinds.

Why not see for yourself the value of Atlantic service? Just write, wire or phone the office nearest you for full information. The Atlantic Refining Company, Dept. R-7, 260 South Broad Street, Philadelphia 1, Pa.

PROVIDENCE, R. I.
430 Hospital Trust Bldg.

SYRACUSE, N. Y.
Salina and Genesee Sts.

READING, PA.
First and Penn Aves.

PITTSBURGH, PA.
Chamber of Commerce Bldg.

ATLANTIC

LUBRICANTS · WAXES
PROCESS PRODUCTS

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

To maintain today's peak production schedules, workmen's hand tools used for assembly, maintenance or repair of equipment must be of high quality. They must be safe and dependable to meet the increased emphasis on the elimination of lost time accidents. They must have long life because production shops keep accurate records on the hourly life of these tools and insist on the ones that last the longest.

Republic Alloy Steels provide tool manufacturers with a combination of qualities essential in the production of socket wrenches, box and open end wrenches, speed handles and screw drivers.

Alloy steels offer a greater degree of safety than other materials because they can be tempered to a greater depth. They can also be heat treated at higher temperatures. Their response to heat treatment is such that uniform structures can be formed in tools where the section mass changes abruptly, as in box wrenches. Higher draw temperatures and greater depth of penetration make a tool that is tougher, able to stand up in severe service.

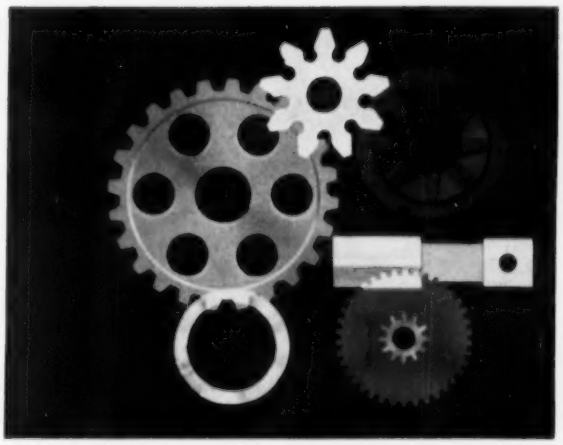
One additional requirement of the modern hand tool is that it be strong, yet easy to handle. Here again alloy steels fit the bill. Their high strength-to-weight ratio permits the use of thinner sections to hold down size and save weight —without any sacrifice of needed strength.

Now, what about your product? Republic metallurgists and engineers are ready to give you obligation-free assistance in the application of these fine steels to your product—assistance that can insure safety, extend equipment life, reduce maintenance and replacement costs. Mail the coupon today.

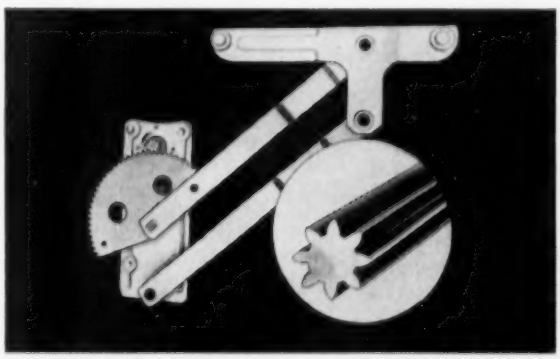
The tools shown at left were made from Republic 4140 Hot Rolled Alloy Steel Bars by The Cornwell Quality Tools Company, Mogadore, Ohio. This manufacturer has used alloy steels for more than 30 years.

STEEL

and Steel Products



REPUBLIC IRON POWDER OFFERS YOU NEW PROFIT OPPORTUNITIES IN SMALL PARTS PRODUCTION. Parts can often be made faster, more uniform and at less cost using Republic Iron Powder. Is is also being used successfully in making complicated shapes which are difficult to produce economically by other means. Republic metallurgists and engineers, with a thorough knowledge of all types of metals, can help you determine iron powder's suitability to your parts production. Or, they can suggest alternate methods or materials better suited to your particular needs. This service is available without cost or obligation. Just mail the coupon.



REPUBLIC COLD DRAWN SPECIAL SECTIONS REDUCE MACHINING ON WINDOW GEAR TO TWO SIMPLE OPERATIONS. The only machining operations required are cutting-off and drilling. The manufacturer uses Republic Cold Drawn Special Sections preformed to the predominating cross section of the gear. Special sections provide almost limitless flexibility in design. They permit replacement of costly assemblies with one-piece shapes. They simplify built-up, interlocking or associated parts. Higher strength, greater hardness and a bright, smooth finish are additional benefits of the cold drawing process. Republic Special Sections are made to specification in all grades of carbon, alloy and stainless steel.

REPUBLIC STEEL CORPORATION
Dept. C-2146
3102 East 45th Street
Cleveland 27, Ohio

Send more information on:

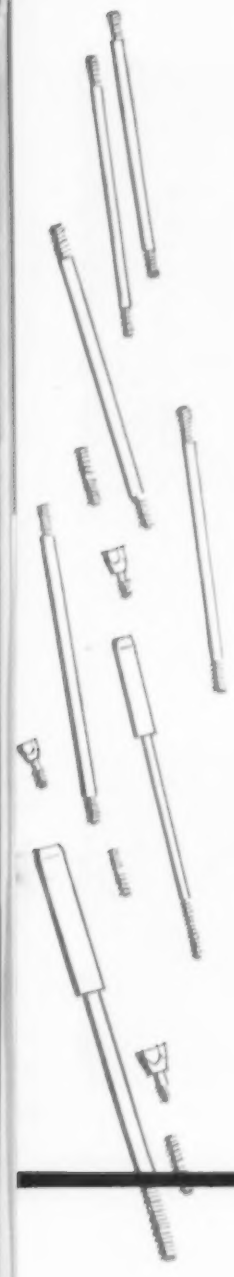
☐ Alloy Steels ☐ Iron Powder
☐ Have a metallurgist call. ☐ Special Sections

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____



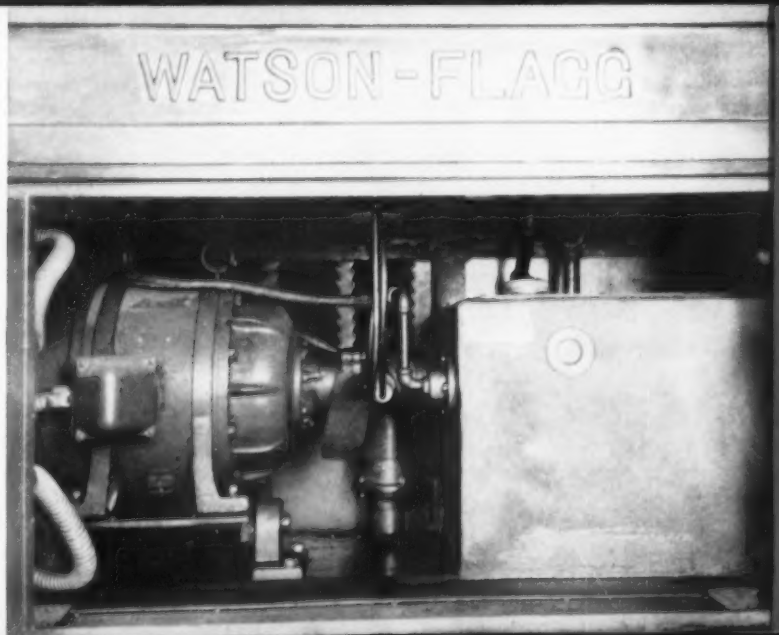
STANOIL *Industrial Oil delivers on tough assignment at Indianapolis Screw Products Corp.*

Rolling threads on aluminum bronze with pitch diameter tolerances as close as .0014″ is a tough job but Indianapolis Screw Products Corporation is used to taking on such jobs and delivering. They give tough jobs to the hydraulic oil they use, too, and they expect it to deliver. They've given such a job to STANOIL and they're getting the results they expect—and more.

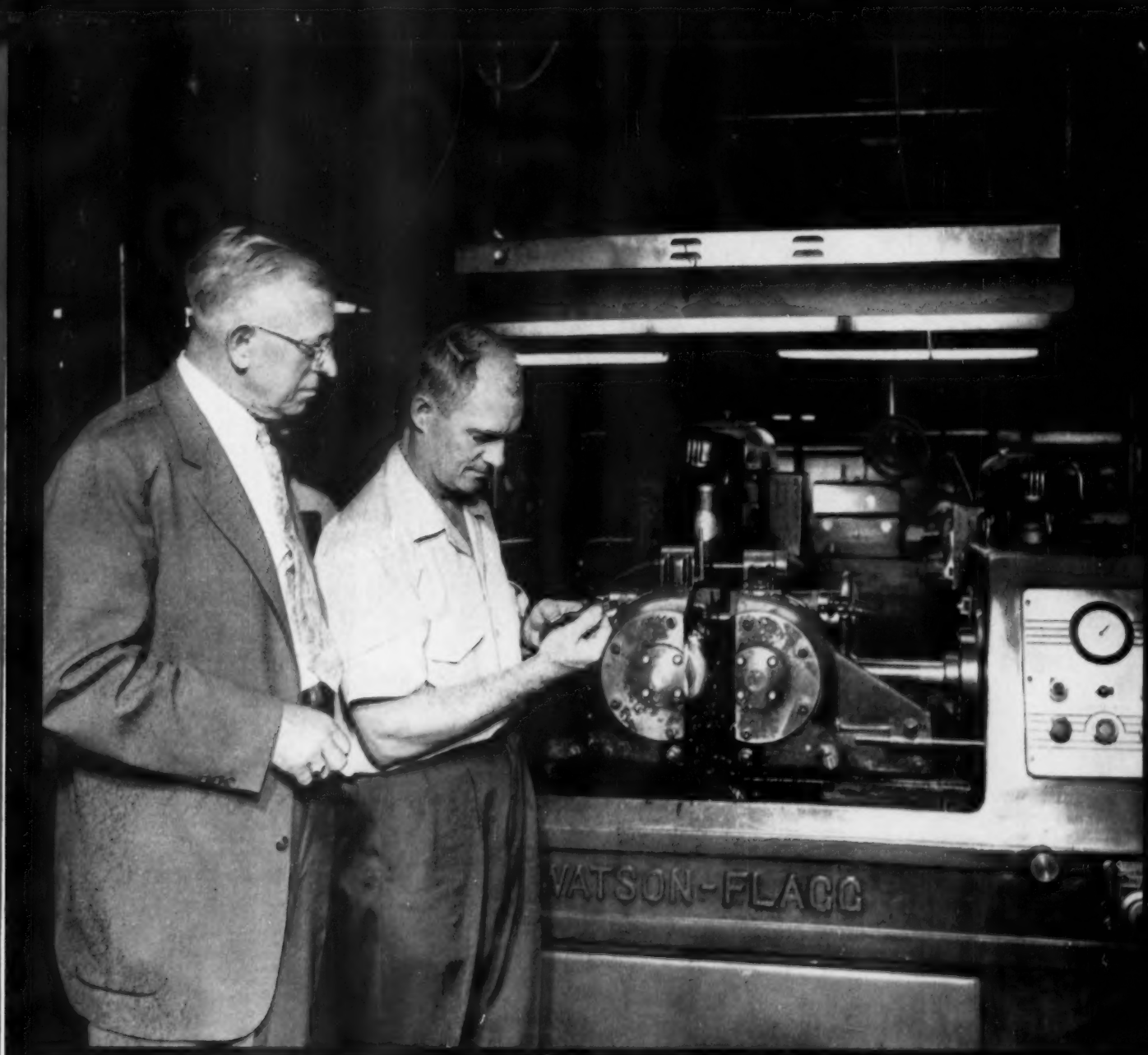
STANOIL Industrial Oil is used in the hydraulic system of a Watson-Flagg precision thread roller in the Indianapolis Screw Products Corporation plant. The system uses a Vickers pump and Cuno filter. The filter has not been cleaned in over a year *because it hasn't needed cleaning.* Here, as in other applications, STANOIL delivers top performance with minimum maintenance and maximum system cleanliness.

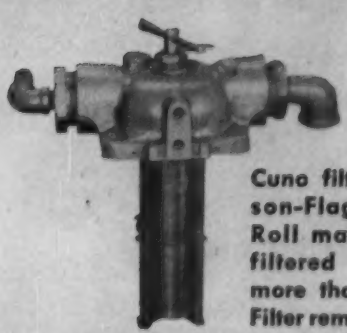
STANOIL likes tough assignments like this one; likes them because it can deliver with plenty to spare.

Perhaps you would like to know about the use of STANOIL in a hydraulic application in your plant. In the Midwest and Rocky Mountain states, a lubrication specialist at your nearby Standard Oil office will be happy to discuss it with you. Call him. Or, if you would like, contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.



Tight gaskets, good maintenance, and STANOIL add up to first rate performance at Indianapolis Screw Products Corporation. This shot of Vickers pump shows how good housekeeping and STANOIL team for top operation on tough assignment.





Cuno filter in Watson-Flagg Thread Roll machine has filtered STANOIL more than a year. Filter remains clean.

Mr. R. W. Williams, Plant Superintendent, checks pitch diameter of thread with Glenn Riggs, Standard lubrication specialist. Glenn Riggs is an old hand at helping industrial firms work out lubrication problems. Glenn has been doing this sort of thing for 28 of the 30 years he's been with Standard. This background and experience, customers have found, pay off *for them.*

STANDARD OIL COMPANY
(Indiana)

STANDARD

45° OR 90° *Powerturn* COPYMATICS

LODGE & SHIPLEY TRACER CONTROLLED LATHES

Lodge & Shipley produces both these versatile duplicating lathes! Now, choose the type that perfectly suits your production. Speaking of production, these new lathes really produce at low cost. They combine proven advantages of all-hydraulic duplication . . . featuring either 45° or 90° tracing slide . . . with all the new POWERTURN features.

There are 5 new sizes and types of COPYMATICS suitable for your needs. Complete details are available in two new pieces of literature: Bulletin 309, 90° COPYMATIC and Bulletin 310, 45° COPYMATIC. For your copies, address: The Lodge & Shipley Company, 3055 Colerain Ave., Cincinnati 25, Ohio.

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. . . offers contour facing as well as turning and boring . . . particularly suited for turning contours involving diameters connected to faces by curves!

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. . . traces in both directions: toward head or tail . . . faces exactly square shoulders . . . maximum versatility and tracing capacity!

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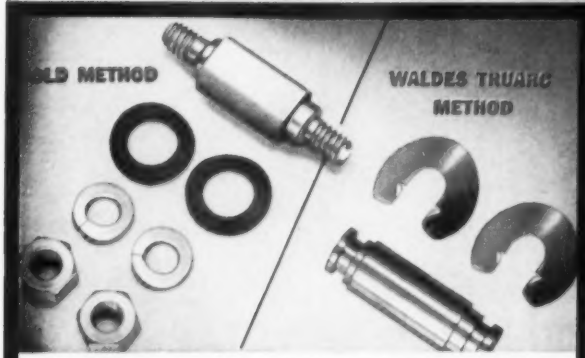
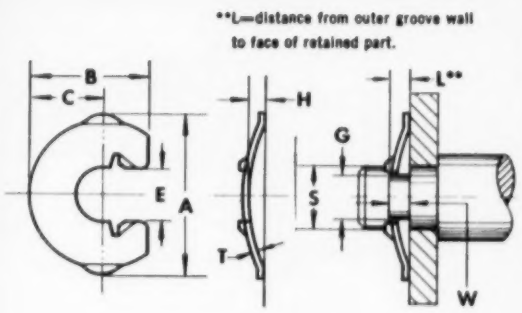
New Waldes Truarc locking-prong ring functions as spring, shoulder, fastener... and STAYS PUT!



Above assembly shows how 2 Waldes Truarc Locking-Prong Rings (Series 5139) replaced 6 parts... eliminated threading operation... and need for skilled labor.



WALDES TRUARC LOCKING-PRONG RING (Series 5139)
U. S. Pat. Pending

Ring No. 5139–	SHAFT		RING DIMENSIONS												average ultimate shear strength lbs.*	GROOVE DIMENSIONS						resilient end play take up L max – L min
	Dia. S	tol.	A	tol.	B	tol.	C	tol.	E	tol.	H	tol.	T†	tol.†		Dia. G	tol.	Width W	tol. –.000	L min.	L max.	
12	.125	±.002	.340	±.010	.307	±.010	.166	±.005	.086	±.004	.050	±.010	.010	±.0013	400	.082	±.0015	.045	+.005	.035	.045	.010
★15	.156	±.003	.380	±.010	.330	±.010	.184	±.005	.108	±.004	.055	±.010	.010	±.0013	600	.104	±.002	.050	+.005	.035	.045	.010
18	.188	±.003	.445	±.010	.390	±.010	.213	±.005	.130	±.005	.060	±.010	.015	±.0015	900	.124	±.002	.065	+.005	.045	.055	.010
25	.250	±.003	.581	±.010	.500	±.010	.280	±.005	.172	±.005	.070	±.010	.015	±.0015	1000	.165	±.002	.070	+.005	.050	.065	.015
31	.312	±.003	.744	±.010	.620	±.010	.360	±.005	.234	±.005	.095	±.010	.018	+.001 −.002	1300	.228	±.003	.080	+.005	.080	.095	.015
★37	.375	±.003	.853	±.015	.740	±.010	.427	±.005	.280	±.005	.130	±.010	.020	±.002	1900	.270	±.003	.105	+.005	.090	.115	.025
★43	.438	±.003	.960	±.020	.820	±.020	.475	±.010	.337	±.010	.130	±.010	.020	±.002	2200	.327	±.003	.105	+.005	.095	.120	.025

Additional Sizes Under Development ★Production dies not available as of date of printing †Applies to unplated rings only *Recommended safety factor =3 to 4.

The Waldes Truarc Locking-Prong Retaining Ring is a new, low cost, radially applied fastener which can be locked positively in its groove and used as a shoulder against rotating parts. It is primarily intended for use in the automotive, electronic and aeronautical industries.

This radially applied ring locks positively in its grooves by means of two prongs at the open end. Because of its high thrust-load capacity the Waldes Truarc Locking-Prong Ring may be used as a shoulder against rotating parts. Its bowed construction provides for end-play take-up in the assembly and makes less critical the tolerances required for the parts being fastened. Since it serves as a spring as well as a shoulder, this ring eliminates the need for springs, washers, and other accessory fastening devices.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types... as many as 97 different sizes within a type... 5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today... let our Truarc engineers help you solve design, assembly and production problems... without obligation.

SEND FOR FREE SAMPLES

WALDES TRUARC® RETAINING RINGS

Waldes Kohinoor, Inc., 47-16 Austel Place, L.I.C. 1, N.Y.

☐ Please send me sample Locking-Prong Rings. (please specify shaft size_____)

☐ Please send me supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.

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Title _____

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AM079

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

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No. 3-36 . . . 36" table travel . . . 64" x 14" table . . . full automatic hydraulic feed.

No. 3-36
HYDRAULIC MILLING MACHINE

Now—the family of Kent-Owens Milling Machines has expanded to give you the same unexcelled milling accuracy, speed and dependability for *larger size work!*

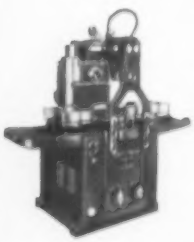
Proudly we present the No. 3-36 Hydraulic Milling Machine . . . the new "big brother" in the line of popular Kent-Owens Millers. Each Kent-Owens machine is ruggedly designed with advanced features throughout for greater dependability and accuracy to maintain tough production schedules. Write for bulletin 955 on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines.

Kent-Owens Machine Co., Toledo, O.

Simple . . . Rugged . . . Efficient

No. 2-20DS . . . Double Spindle for two milling operations . . . 20" table travel . . . 42" x 12" table. Hydraulic feed.

No. 1-14 . . . 14" table travel . . . 32" x 9" table . . . hydraulic table feed . . . full automatic cycle.



No. 2-20 . . . 20" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.

No. 1-M . . . Hand feed to table and head . . . 25" x 9" table . . . 12" table travel . . . head counter-balance is adjustable.

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for MILLING MACHINES

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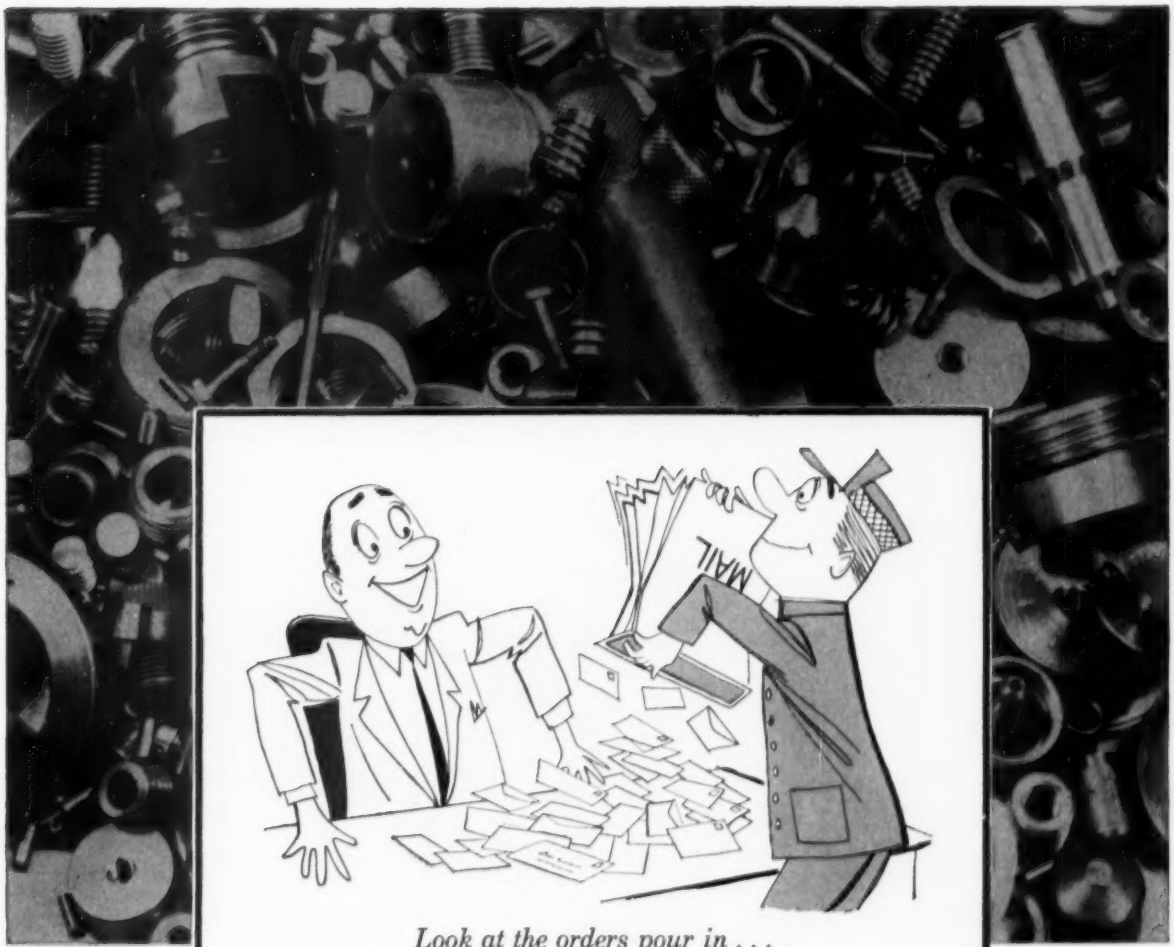

Look at the orders pour in . . .
now that we've got our prices down by using MX

You give yourself—and your customers—a break when you switch to USS Free-Machining MX Steel.

With this faster-cutting screw stock your production goes up and your costs come down. Your screw machine parts, no matter how intricate, can be turned out at higher speed. More accurately. With better finish. And with less tool wear.

Although it costs no more than ordinary screw stock, USS Free-Machining MX has been successfully machined at speeds up to 350 SFM—speeds far higher than the average (under 250 SFM) used for the everyday jobs which are the backbone of the industry. What's more, MX works *with* your tools not against them . . . will prolong tool life up to 200%.

As a result, cost savings with USS MX have run as high as 42%—generally average between 10 and 15%.

Such savings have been so consistently recorded in every shop where MX has been given a thorough trial that we feel safe in saying that *MX will cut the cost of any part* you now machine from ordinary screw stock. The more machine work required, the greater your savings.

You can easily prove this for yourself by giving MX a production run in your own shop. Produced in all the popular screw stock sizes, it is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trademark. In hot-rolled form, MX is available direct through our nearest district sales office.

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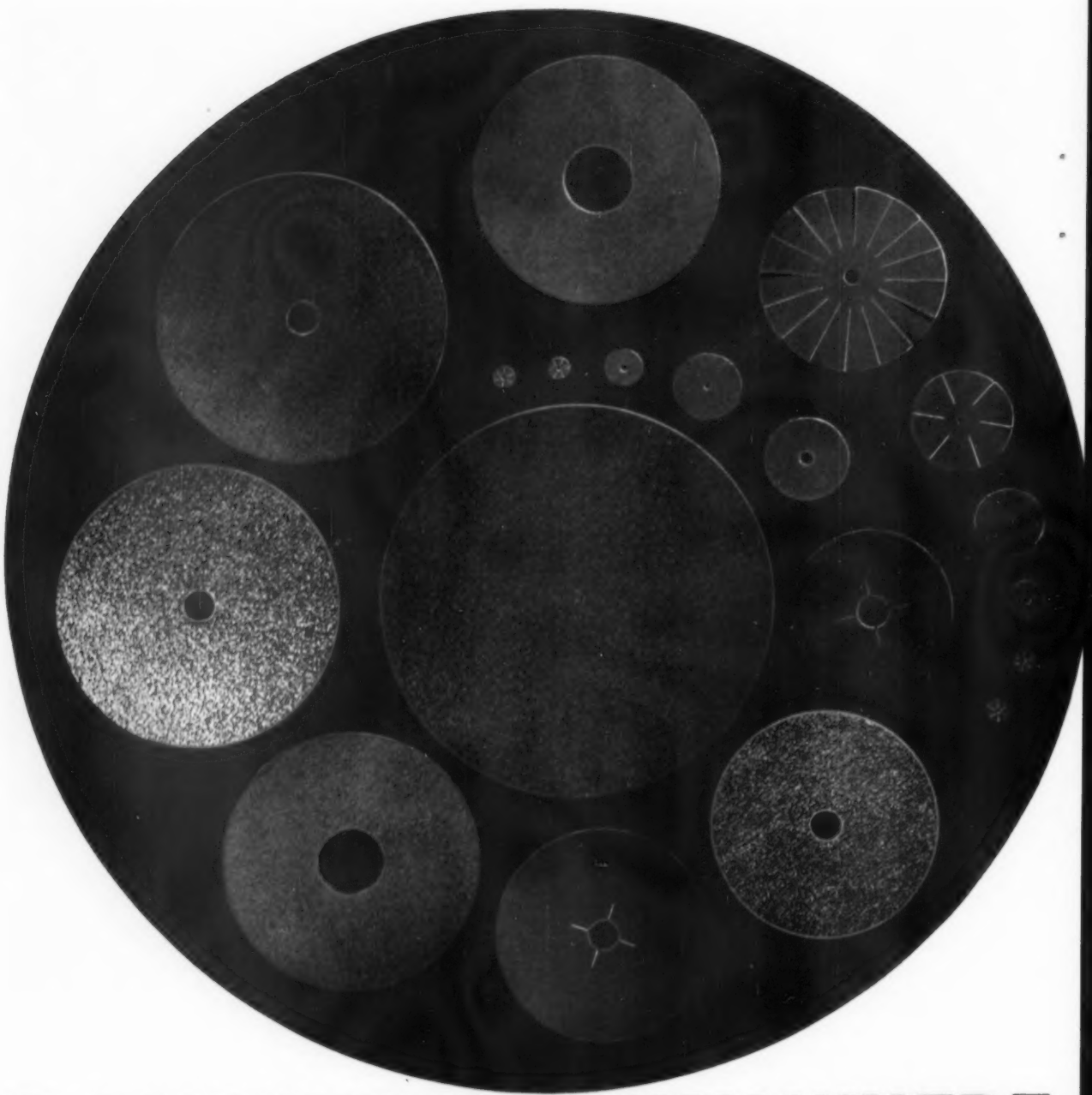
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Longer tool life . . . bigger output . . . lower costs
***—when you do the job with free-machining* MX**

USS

UNITED STATES STEEL



TO SMOOTH THE WAY WHERE

JEWEL BRAND GRINDING DISCS

A wider selection of grinding discs especially designed for rapid removal of excess metal as well as for fine finishing of hard or soft metal products is offered in the JEWEL BRAND line.

JEWEL BRAND Grinding Discs are made in all standard diameters and in all degrees of coarseness or fineness with vulcanized fibre, cloth or other backings coated with the world's best abrasive grains. There's a standard or special JEWEL BRAND Grinding Disc to meet every need where the use of an abrasive disc is indicated.

A COMPLETE LINE OF ABRASIVES

Abrasive Products, Inc., manufactures a complete line of JEWEL BRAND coated abrasive products — belts, rolls, sheets, discs, and specialties in a wide variety of shapes and sizes.

MODERN FACILITIES AND MANUFACTURING METHODS

Modern methods and equipment, expert craftsmen, plus carefully controlled grading by the JEWEL triple-screening process, assure uniformly-high standards of quality throughout the JEWEL BRAND line. In the plant of Abrasive Products, Inc., over 250,000 square feet of floor space is devoted to the manufacture of JEWEL BRAND abrasive papers and cloths.

SKILL PLUS WILL

You'll find that AP salesmen not only have the skill to solve problems involving the use of abrasives, but the willingness to continue to search for better ways after problems are solved. Try this combination for best results in the long run.

THE GOING IS ROUGH

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JEWEL ABRASIVES

coated abrasives

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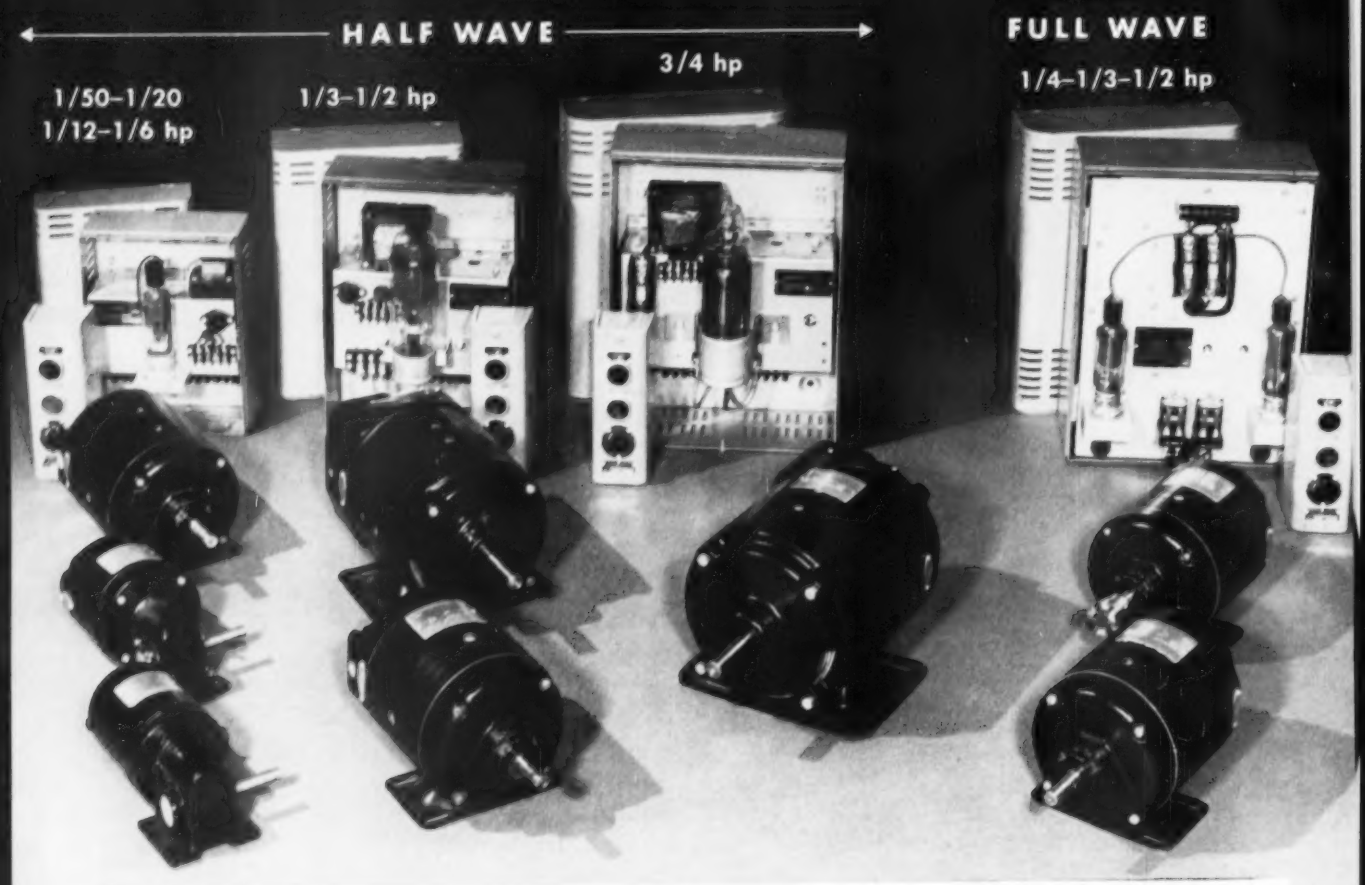


A DRIVE TAILORED TO EVERY JOB is the achievement of General Electric engineers who designed the new fhp Thymotrol drive line. Here are examples of this versatility:

Three panel sizes now cover the fhp range, making smaller ratings more compact, more economical than ever before.

Full range of ratings

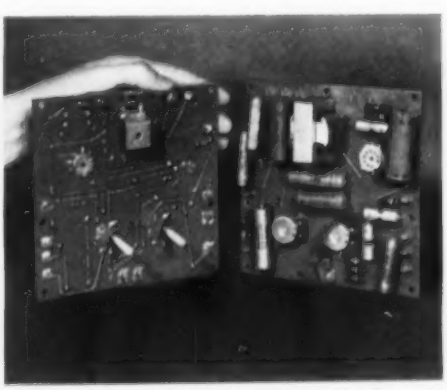
- Horsepower: 1/50 to ¾†
- Power supply: 220 v a-c, 50/60 cycles
- Speed range: 20 to 1
- Speed reg.
  (NL to FL): half-wave — 3%, full-wave—5% (adjustable to flat at any specific speed)

†Plus a full line of integral-hp drives.

Building-block design—you get the exact performance you want by selecting any combination of these optional features:

- Reversing operation
- Jogging (pre-set or run)
- Dynamic braking
- Tachometer follower
- Overload relay protection
- Tube warm-up protection

ONE-TUBE DESIGN of G-E half-wave Thymotrol drives minimizes tube maintenance. This type drive is suitable for most adjustable-speed jobs.



PRINTED CIRCUITRY, DIP SOLDERING are effective techniques which permit new lower General Electric prices. Exhaustive tests prove the sturdiness of this construction for industrial use.

PLUG-IN PANEL BOARD can be quickly removed for maintenance or replacement to minimize downtime—a must on such jobs as production conveyors.

GENERAL ELECTRIC ANNOUNCES . . .

NEW full line of fractional-horsepower G-E Thymotrol* adjustable-speed drives—more compact, more rugged, more reliable, easier and more economical to maintain, yet priced up to 18% below previous models

General Electric announces a completely re-designed line of fractional-hp Thymotrol adjustable-speed drives—***designed to save you up to 18% over prices of previous models.*** These versatile new drives are applicable to conveyors, machine tools, in fact, to almost every small machine whose performance can be improved by adjustable speed.

SELECT JUST THE DRIVE YOU NEED —AND SAVE MONEY!

Biggest cost-saving for you with new G-E Thymotrol drives is that you buy only as much drive as you need. For some applications, you'll want only the basic half-wave drive: motor, simple one-tube control, and control station. For more complex jobs, you can select any combination of seven different optional accessories to provide desired performance. To further match drive to job, these popular half-wave drives come in three panel sizes.

For rapid acceleration of high-inertia loads, for extra-smooth performance, or for flat speed-regulation adjustment, you'll want the new full-wave Thymotrol drive, with still other optional features.

NEW DESIGN IS SIMPLE, RELIABLE

In designing new G-E Thymotrol drives for mass production, G-E engineers have also included many new features for longer life, lower operating costs, increased reliability:

Plug-in panel boards on half-wave units can be quickly removed without disturbing customer wiring for fast inspection, repair, or replacement, minimizing downtime.

Printed circuitry and dip soldering result in more compact units which simplify your design problems. Shock and vibration tests show this construction really stands up in industrial use. Parts replacement is simple using soldering iron and pliers.

20:1 speed range is now standard on all ratings. And operator can turn machine to full "off" with speed-control knob.

High tube reliability—all tubes on G-E Thymotrol drives are fully guaranteed for one year, usually last far longer.

SIMPLE PACKAGED DRIVES OR ENGINEERED MULTI-MOTOR SYSTEMS

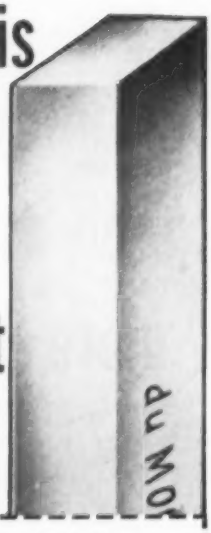
Whatever your adjustable-speed needs, from packaged single-motor drives to specially engineered multi-motor systems, you'll find the answer—***at new low prices***—at General Electric. See your G-E Apparatus Sales representative today. Or write for Bulletin GEA-6519 to Sect. 791-3, General Electric Co., Schenectady 5, N. Y.

*Trade-mark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Clip this to get longer tool bit life



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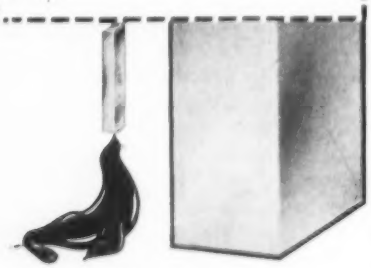


duMont Tool Bits hold a keener cutting edge longer, give you more cuts per bit more cuts per dollar. That's because *toughness, red hardness and wear resistance* are in almost perfect balance.

duMONT TOOL BITS
High Speed, Ground Square and Rectangular

Backlash

SEND LETTERS TO:
BACKLASH EDITOR American Machinist
330 W 42nd ST, N Y 36, N Y

Super Gearing

Accurate gearing is here to stay, and your article (AM — May 21 '56, p 129) performs a valuable service in pointing the road down which one fine company has traveled.

I learned my lesson in producing mechanisms for the accurately timed release of a bomb from a platform moving at 300 mph, 40,000 ft up in the air. In many ways, the measure of our success is the measure of the control over the inaccuracies in our gearing.

R E W Harrison
Washington, DC

The Reason Why

In your very interesting article on disaster control (*AM*—Feb 27 '56, p129) I find no mention as a reference for further study of our plant protection service operations manual OM 16-1.

This was the first and, as far as I know, still is one of the very few industrial protection manuals published by individual State civil defense agencies and, of course, has wide and continuing distribution throughout New York industrial installations.

A C M Azoy
Chief, Plant Protection Service,
New York State
Civil Defense Commission

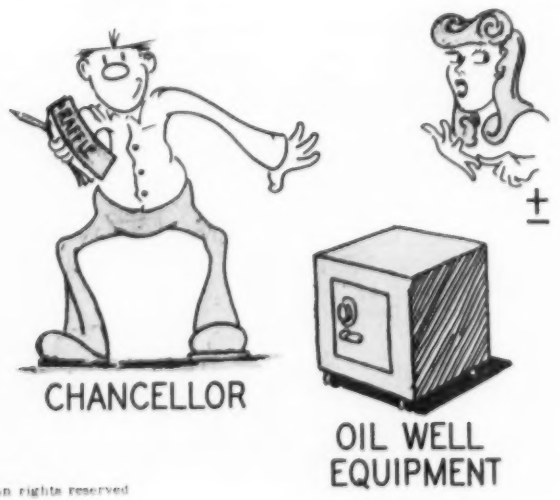
Inasmuch as this article was published on a National basis, we purposely did not include reference to any State or private company manuals. However, a very extensive bibliography is available from the Federal Defense Authority and various State CD Agencies—Ed.

Is Apprenticeship Obsolete?

The excellent editorial on this subject (*AM*—April 23, '56, p111) should have careful consideration, as it is a most important subject. Assuming apprenticeship to mean an understanding of the fundamental principles of machine tools and their operation, it will never be obsolete so long as we depend on men and women to design and build machines to meet new demands as they

GRINETICS

By D G SMITH



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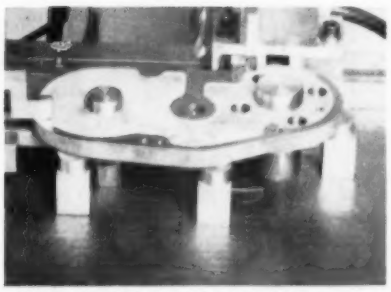
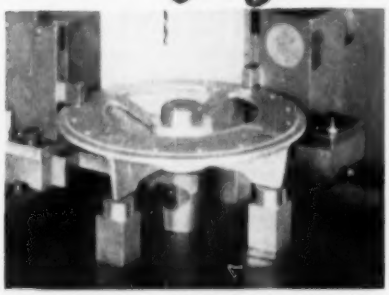
DRILL PARTS LIKE THESE . . . *Without Jigs!*

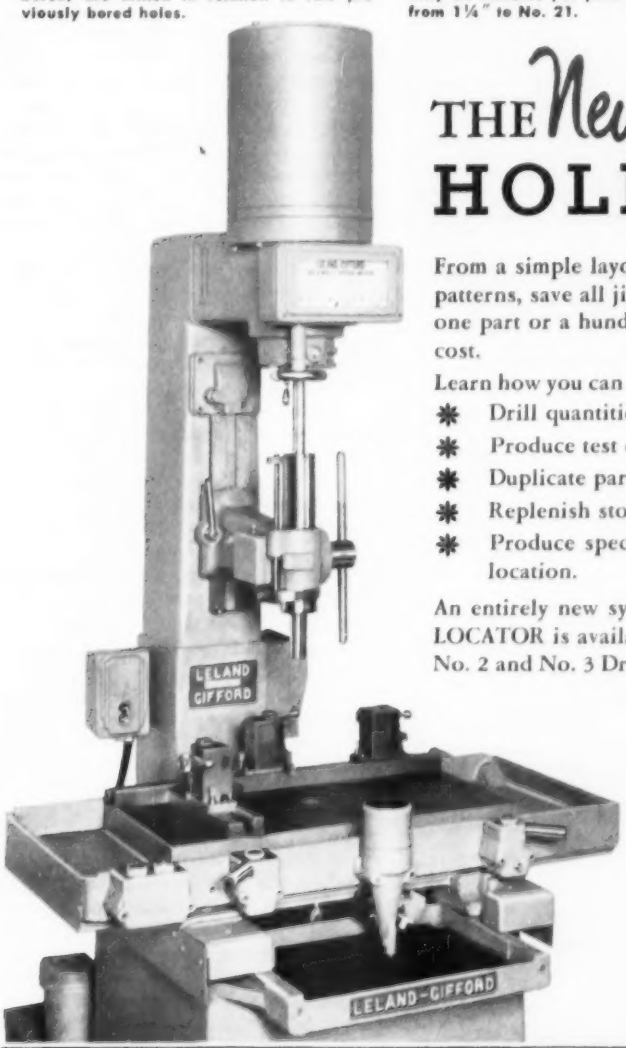


Thirteen holes (4 tapped, 1 reamed, 4 counterbored) are drilled in relation to two previously bored holes.

Nine holes plus five extra operations take only 24 minutes per part. Hole sizes range from 1¼" to No. 21.



Twelve holes are drilled and tapped in this aluminum motor fan in precise relation to the hub and webs.



THE *New* LELAND-GIFFORD HOLE LOCATOR

From a simple layout chart, you can locate and drill complex hole patterns, save all jig costs, eliminate piece by piece layout, produce one part or a hundred in a fraction of the time, at a fraction of the cost.

Learn how you can use the new Leland-Gifford HOLE LOCATOR to:

- Drill quantities of parts not requiring jig borer accuracy.
- Produce test or experimental pieces.
- Duplicate parts for repair or maintenance.
- Replenish stocks of replacement parts.
- Produce special parts requiring modification in hole size or location.

An entirely new system for locating and drilling holes, the HOLE LOCATOR is available in the capacities of standard Leland-Gifford No. 2 and No. 3 Drilling Machines. Write for complete information.

HOW IT WORKS

Hole locations are precisely established from intersecting lines scribed on a metal chart from blueprint dimensions. An optical viewer with double cross hairs and 20X magnification aligns the table with the layout chart which is registered in relation to the machine spindle. Dual locks release to permit lateral, forward and back, or compound motion of the table. The work is held on the table by quick-acting clamps. Duplicate parts can be produced from the same layout or the chart can be filed for future use.

LELAND-GIFFORD
Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

CHICAGO 45
2515 West Peterson Ave.
DETROIT
10429 West McNichols Rd.
CLEVELAND 22
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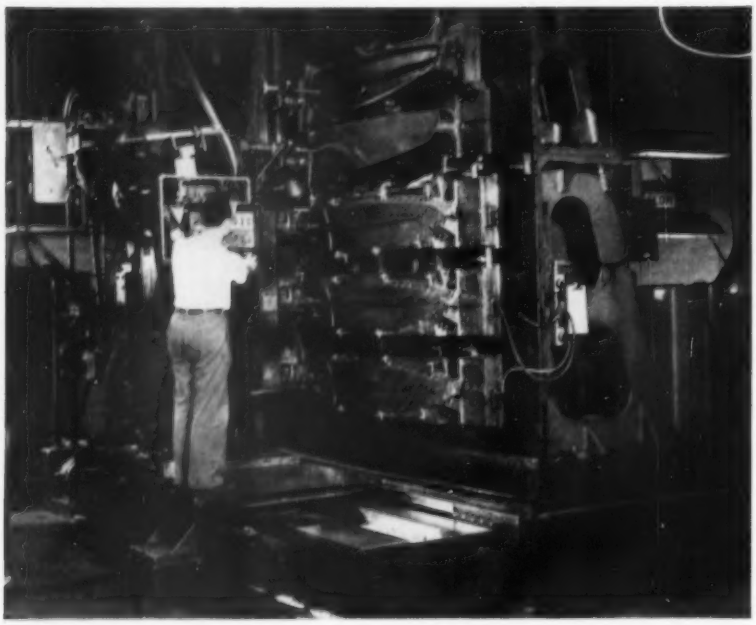
NEW YORK OFFICE
75 South Orange Ave.
South Orange, N. J.
LOS ANGELES OFFICE
2620 Leonis Blvd.
Vernon 58, Cal.
INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 12, P. O. Box 24, Charlotte Station

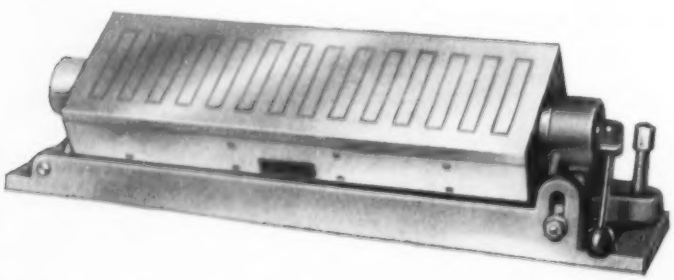
Walker Does it Again-



Three WALKER electro-magnetic chucks mounted on milling machine, making possible profile milling three propeller blades in one operation.

WALKER engineers and makes chucks for unusual applications as well as standard holding devices for irons and steels, non-ferrous metals and non-metallic materials.

Whatever your holding problem the originators of the magnetic chuck will solve it for you.



AND—A Walker Permanent Magnetic Swivel Chuck—a type heretofore limited to Electro Magnetic Chucks. Another one of many applications by Walker.

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

IN CANADA—UPTON BRADEEN & JAMES, LTD.

arise. However, many of the skills needed 40 or 50 years ago are no longer necessary, and it would be a waste of time to teach them.

I recall when it was part of apprentice training to learn to chip and file a block of cast iron into as nearly perfect a cube as possible. Some apprentices did a remarkably good job and learned great accuracy with both chisel and file. But such skills are unnecessary today, except in very rare instances, and should not be taught to the average machine shop apprentice.

There are certain fundamentals which an apprentice should know, regardless of the sort of work he will eventually handle. He should know the correct, or generally accepted names and functions of various parts of machines, because misunderstanding can lead to confusion, delay, and expense. He should also learn the functions of machine elements and the usual calculations required for their operation—not for design purposes, but for a proper understanding of the operation of the various machines he will use. While there is no longer any need to calculate change gears for screw-cutting, now that all lathes have quick-change gearboxes, he should know about gear ratios.

Although he may seldom use the old type of firm-joint caliper, it will help to learn the "feel" of caliper points as they contact the work. I recall instances where work was rejected because of the difference in practice in different shops. In one, they considered the piece right when the calipers would drop over the work by their own weight, while the other felt that a little pressure should be necessary. Similar differences still exist as regards plug and ring gages.

Anyone who expects to advance in any line of machine work will want to understand the principles of the machines he is likely to encounter, but there is little need of his learning how to run every type, as was the case in the old days. But he should know enough about machines in general so as not to be afraid of them, even though he might hesitate to actually run one without detailed instruction.

It is important in modern training that the learner understands the necessity for accuracy, and the ways in which work is measured and inspected. It is also essential to stress the importance of careful assembly —a weak spot in too many shops where mass production seems to be the main goal. As was pointed out in these columns (*AM*—April 9 '56,

p101), no matter how accurately the parts of any machine may be made, their satisfactory performance depends largely on how they are put together. I am sure that apprentice instructors will find many places where some sort of fundamental teaching will serve as a basis for training in a plant making a widely diversified product.

Fred Colvin
Pt Pleasant, NJ

Never!

Just so long as craftsmen are needed, just so long will apprenticeship be needed. We can never, but never, do away with the ned for proper all-around apprenticeship.

Robt Ankers
Cincinnati

Try This for Size

I don't think A H Sears, of Rochester, (*AM*—May 21 '56, p92) can do very much towards rating and classification of his presently employed toolmakers and machinists.

However, I would like to suggest a possibility for consideration. He can start an in-plant training program. This program can be made very effective. We have a similar plan in New York City to the one I am suggesting here.

I teach machine shop at the Samuel Gompers Vocational High School in the Bronx and have been teaching for 20 years. As the boys attend class, I observe them and can, in a short time, evaluate their trade possibilities. The better boys are earmarked for employment in tool and die making if they show that important little something required to succeed at that work. Boys who show good possibilities as all-around machinists are similarly earmarked. The remainder are destined to become machine operators and specialists. I also do the placing of these young men so I can satisfy the industrial firms when the boys graduate from school.

I observe the boys in our automotive shops and get a line on those who have possibilities for the erection and assembly of machinery. These young men are referred to industry for these specializations. Automotive work today is to remove and replace and adjust.

If Mr Sears would visit the local Vocational Trade and Technical High School in Rochester, I am sure a working arrangement could be a helpful step towards a long-range solution of his problem.

Walter N Schuhmacher
Flushing, NY

ACCO products

Wilson "Rockwell"* Hardness Testers

Production line speeds with laboratory accuracy

• There is a WILSON "ROCKWELL"* Hardness Tester to meet every requirement—from laboratory testing to automatic testing at the rate of 1000 pieces per hour.

J Model
Manually operated

Supplied in both NORMAL and SUPERFICIAL testing types. Designed for testing tools, machine parts and all ferrous and non-ferrous metals, hard or soft, except thin sheet steel.

Y Model Motorized

Suitable for testing work now being done with J models when it is advisable to increase testing speed. Motorized mechanism removes the major load in the test cycle. Set-O-Matic Dial Gauge eliminates need of manually setting dial gauge to zero.

Fully Automatic

Executes complete test cycle automatically at the rate of up to 1000 pieces per hour. Will classify tested parts as "correct," "too hard" and "too soft." Controls hardness limits within two Rockwell numbers. Has safety stop if pieces are not fed properly.

A WILSON hardness testing expert is located near you. Save time and money on your Testing problems. Write or call today.

**Trademark registered*

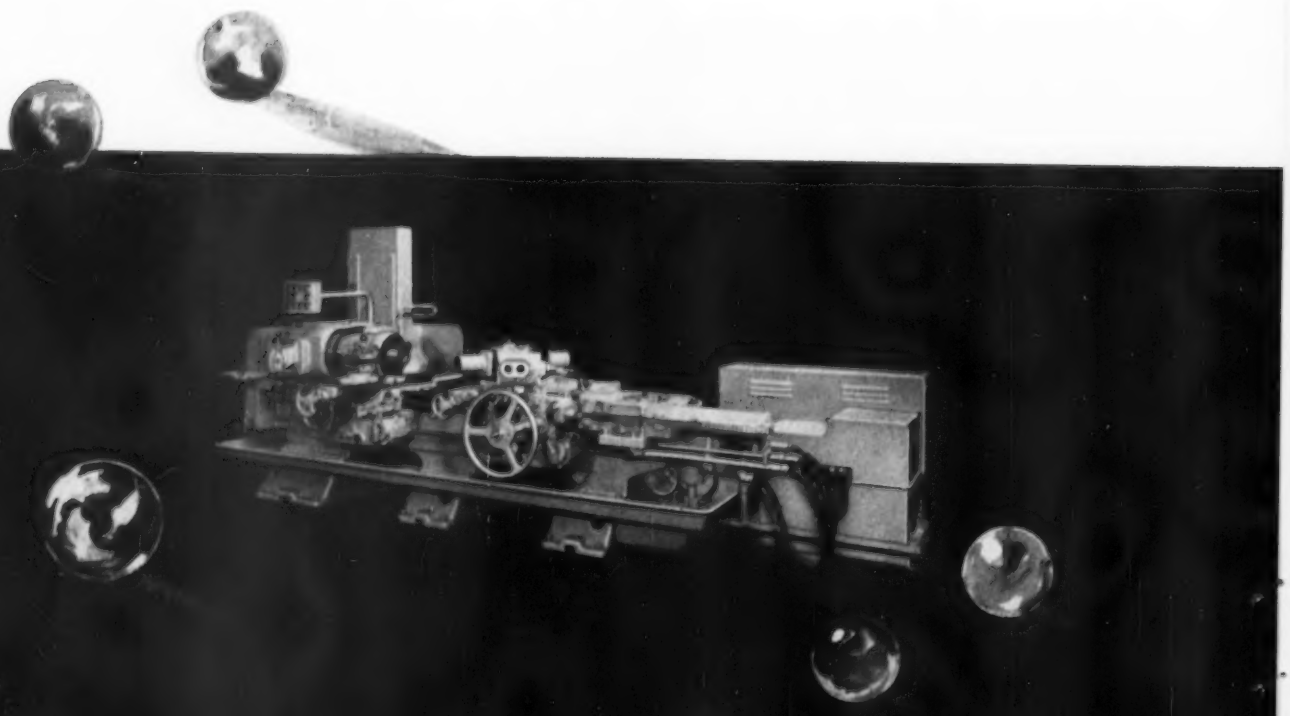
WILSON "ROCKWELL"...

the world's standard of hardness accuracy

ACCO Wilson Mechanical Instrument Division
AMERICAN CHAIN & CABLE
230-B Park Avenue, New York 17, N. Y.

for Better Value

CHILD'S PLAY



Speed is not enough! To pay for itself out of reduced operating costs and increased profits, today's machine tool must be:

1. Easy to understand. 2. Child's play to operate.

3. Quick to convert in change-over and re-tooling.

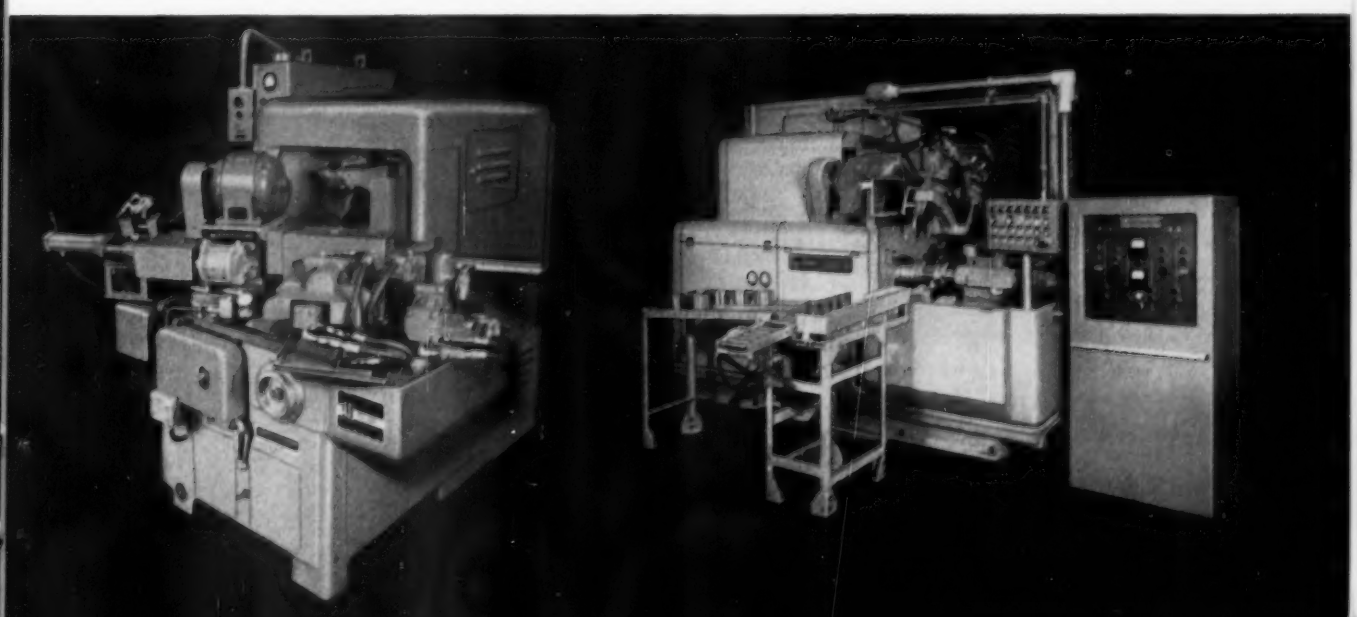
4. Push-button simple to demonstrate in operator training.

Here are a few of the many advanced engineering features which have made today's Jones & Lamson machine tools the most flexible and cost-efficient metal cutting equipment in the industrial world today.

Two-way tracing combined with normal turret lathe operation; Hydra-clutch headstock and Geneva saddle for simple "on the machine" handling; Automatic handling, gaging, chip disposal, sorting, tool adjustment on single spindle automatics; Tape controlled turret lathes for flexibility on long or short run jobs with pre-set tooling, no hand controls; Thread and form grinders with fully automatic handling and machining cycles; Contour grinders controlled hydraulically or optically, and "Automatic thread chasing on standard turret lathes".

JONES & LAMSON MACHINE CO • 502 CLINTON ST • SPRINGFIELD, VT.

Turret Lathes *Fay Automatic Lathes* *Milling & Centering Machines* *Thread & Form Grinders* *Optical Comparators* *Threading Dies & Chasers*

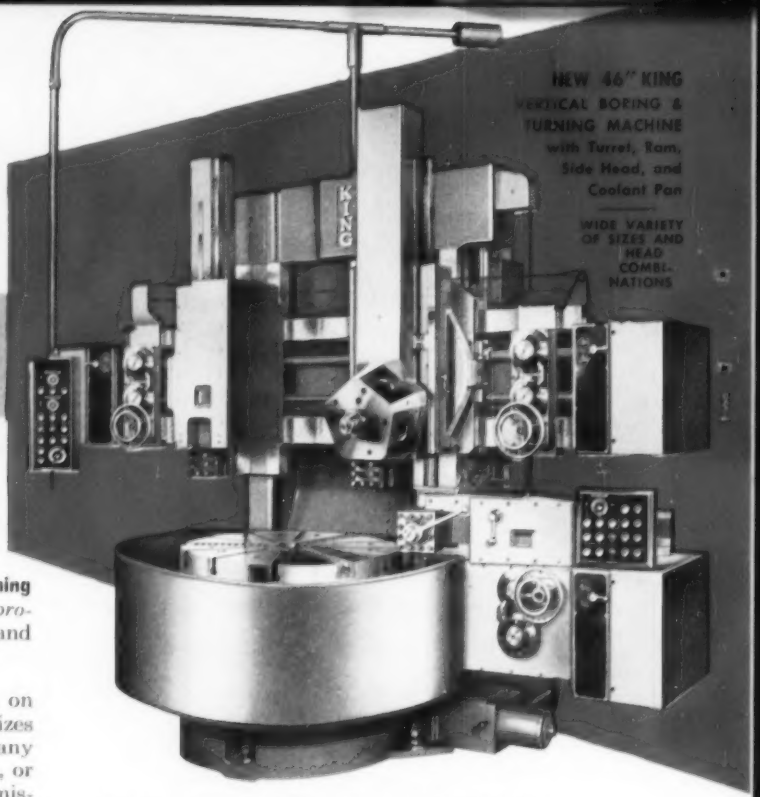


POWERED FOR PRODUCTIVITY

...the all new

KING

greater horsepower — expanded speed and feed ranges — permit use of modern cutting tools to their fullest capabilities


NEW 46" KING
VERTICAL BORING & TURNING MACHINE
with Turret, Ram, Side Head, and Coolant Pan
WIDE VARIETY OF SIZES AND HEAD COMBINATIONS
KING

Completely re-designed King® Vertical Boring & Turning Machines bring to boring mill users the *greatest productive capacity ever achieved* for vertical boring and turning work.

Horsepower has been increased to 40 to 50 H. P. on 30" to 46" machine sizes; 75 to 100 H. P. on sizes 56" and up. Spindle drive provides 24 speeds in any one of three standard ranges: high, intermediate, or low. As illustrated below, complete drive transmission is mounted in an extra-rugged housing, providing greatly increased stability. The entire drive can be removed from the machine as a unit.

24 feeds from .0016" to .250" per revolution are provided. The exact feed can be selected to produce the desired surface finish on any material at the required production rate.

Complete electrical controls are provided, located on pendant station and on fixed panel mounted on side head, for maximum ease and speed of manipulation.

With many other features, the *all new* King provides industry with a high-efficiency machine tool capable of taking full advantage of new cutting tools, new materials, new methods. For full details, send for new Catalog K-5. Write direct or to the King distributor in your area.

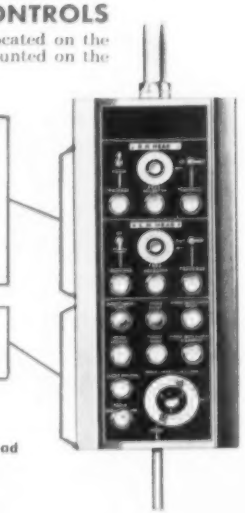
Additional Features of the ALL NEW KING

- **NEW SPINDLE AND SPINDLE MOUNTING, PROVIDING MAXIMUM TABLE STABILITY.**
- **AUTOMATIC LUBRICATION OF ALL MOVING PARTS.**
- **ANTI-BACKLASH NUTS FOR ALL CROSS-FEED MOVEMENTS.**
- **MACHINE ADAPTED FOR SIMPLE OPTIONAL ADDITION OF:**

Automatic positioning of heads.
Automatic tracing control of heads.
Automatic cycling.
Power rail clamping.
Power indexing of turrets.

COMPLETE ELECTRICAL CONTROLS

All electrical controls are conveniently located on the pendant station and on a fixed panel mounted on the side head, as follows:



LOCATED ON PENDANT—

Feed and rapid traverse movements
— and —
Pre-selective feed selection from direct-reading dials:
for rail heads on machines with two heads on rail . . . for rail head and side head on machines with one head on rail.
Power swiveling of rail heads

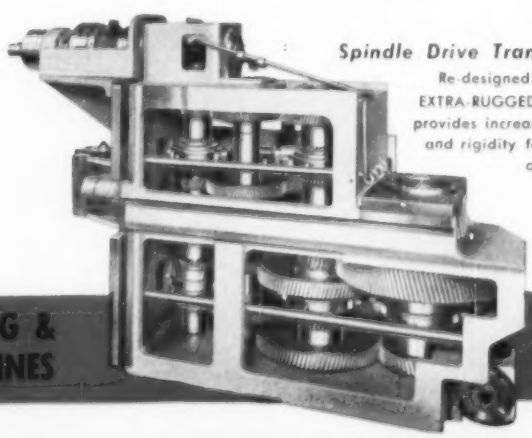
Pre-selective speed selection from direct-reading dial
Speed change • Turret index • Table stop

LOCATED ON SIDE HEAD PANEL—

Feed and rapid traverse movements of side head
— and —
Pre-selective side head feed selection from direct-reading dial: on machines with two heads on rail.

Main drive • Rail positioning • Coolant pump

Thread cutting and taper turning selection for all heads



Spindle Drive Transmission

Re-designed throughout. EXTRA-RUGGED HOUSING provides increased stability and rigidity for mounting of the shafts.

•

Short shafts used throughout with points [illegible] located adjacent to bearing [illegible]

American Steel Foundries
KING MACHINE TOOL DIVISION
1150 Tennessee Avenue • Cincinnati 29, Ohio

KING VERTICAL BORING & TURNING MACHINES

Spot news...

- **Photo-sensitive painting of automobiles is a distinct possibility** in the near future. All cars would go to the dealer as a neutral white, where they would be (for example) colored to match your wife's dress with an electro-magnetic radiation gun. Tired of the color? Run it through an electrostatic or supersonic energy field, and you can start all over again.

- **Georgia Chamber of Commerce is recommending these changes** in that state's workmen's compensation laws: (1) that an employer be freed of liability for an employee's on-the-premises heart attack if the heart condition existed previously and no undue exertion is involved, and (2) that when an employee is injured by a third party, the employer be allowed to sue for compensation paid.

- **Ford will soon install a large number of magnetic tape-controlled machine tools.** Several are already in operation at its Aircraft Engine Division, Chicago.

Tooling costs 30 times higher and manufacturing time 30% longer are estimated for forged parts over cast parts in identical light metals by a French firm studying Al and Mg castings for French military aircraft. Cast parts on France's new Arsenal 1402 jet interceptor save 50%, according to reports.

- **A 1.7-million-sq-ft plant is being built under a 1400-ft-high mountain** in Alabama by American Machine & Foundry Co. AMF says the underground plant can be built at a lower cost than a comparable surface plant—and that maintenance costs will be considerably lower.

- **General Motors will build a $10-million truck plant near Sao Paulo, Brazil.** It's expected to turn out 100,000 trucks by 1963 using almost 100% made-in-Brazil parts after the first four years. It's rumored Ford may do the same.

- **Auto people are experimenting with nylon bearings,** report they're "very good —even excellent" for thrust bearings on crankshafts.

New progress on the government's program to build up reserve marine turbine and gear capacity: General Services Administration has sent out tentative contracts to 10 turbine and gear manufacturers under which the companies would buy some $40 million worth of machine tools as agents of GSA. They'll buy boring bars and mills, broaches, drilling machines, gear cutting and finishing machines, grinders, lathes, and milling machines.

- **New engineering standards for ultrasonic equipment** will be formulated by men from 17 companies under direction of the new Ultrasonic Manufacturers Assn.

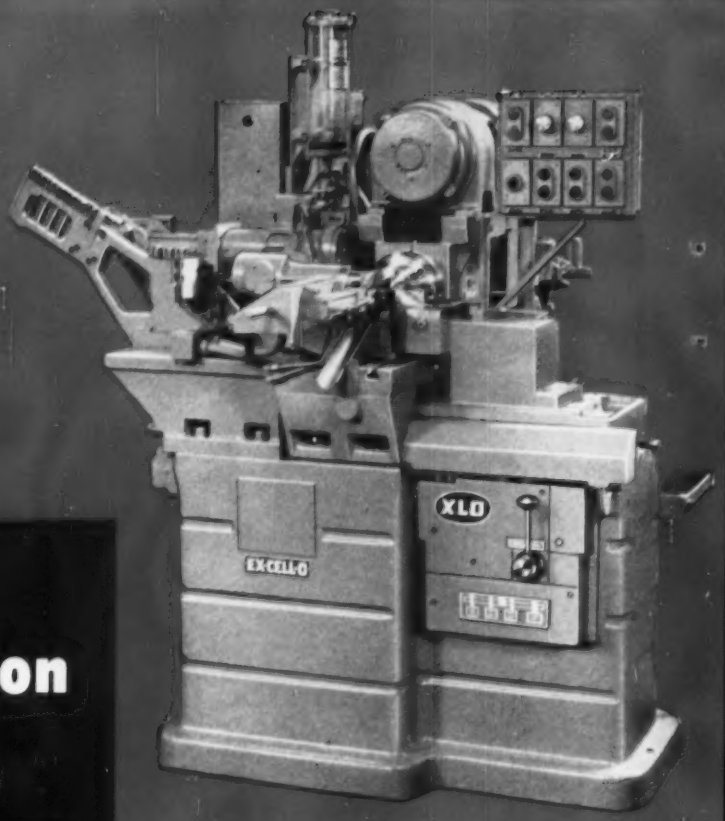
- **Navy's plan to buy $3.5 million worth of machine tools for replacement** is (at press time) still bottled up awaiting Budget Bureau OK. Trouble is, this is the first time the U S has ever bought tools by replacement formula.

- **Fully automatic production of mild steel chain up to 4 in. dia** is slated for a new designed-in-Sweden plant to be built at Pontypridd, Wales.

- **Gray iron castings twice as strong as any turned out in the U S** are claimed for Japan's new Sendite Process, which supposedly prevents carbon from forming into strata—a prime cause of fracture weakness in GI castings.

Automatic Handling Speeds Production

On a Standard Ex-Cell-O Precision Boring Machine



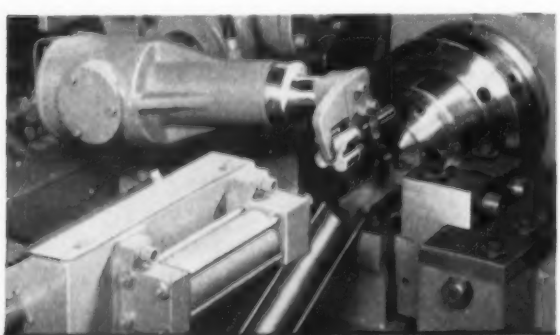
Ex-Cell-O Style 2112-B Precision Boring Machine equipped with a single work spindle and special work handling devices for automatic loading, machining and ejecting.

For a Fraction of Special Machine Cost

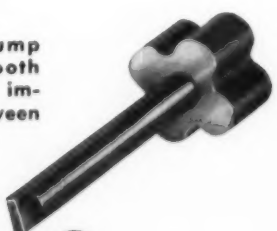
This standard Ex-Cell-O Precision Boring Machine is equipped for facing both ends of oil pump impellers. With automatic work handling equipment it operates at a net production rate of 156 pieces per hour. The use of a standard machine keeps the original cost at a minimum.

In a completely automatic cycle a loading arm picks a part from a chute and loads it into the chuck, then the parts are clamped, machined and ejected.

The flexibility of standard Ex-Cell-O Machines permits low cost automated operation with the addition of work handling equipment. Such a machine may be profitable in your plant. Wire or write Ex-Cell-O in Detroit.



The loading arm is about to load the part into the chuck. After machining, part is ejected into chute in foreground.



In straddle facing oil pump impellers (at right) smooth machine performance is imperative. Width limits between faces are held to .0005".

EX-CELL-O

CORPORATION

DETROIT 32, MICHIGAN

XLO — EX-CELL-O for PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-17

Washington ... NEWS REPORT

Budget boost for B-52's . . .

Congress will add at least $500 million to the administration's fiscal 1957 Defense Dept appropriation.

Most of the extra funds are for production of Boeing B-52 heavy bombers. The budget comes in the midst of heated political controversy over the adequacy of the nation's airpower program —and a special Senate investigation into the program by Senator Stuart Symington's Armed Forces Subcommittee.

Right now, Boeing has orders for 500 B-52's. The Air Force plans to order an additional 100 planes in 1958-59. The extra funds to be voted by Congress would allow the Air Force to place at least half these orders one year earlier. (According to Pentagon estimates, the Russians will have about 1200 heavy bombers by 1958-59.)

The Congressional effort to hike defense appropriations comes on the heels of Senate testimony by two top Air Force leaders who are bucking administration policy and are calling for more money. General LeMay, head of SAC, asked for $3.8 billion more yearly to step up B-52 production and bomber base construction. Lieut General Putt, Deputy Chief of Staff for Development, said important research projects are being delayed or cancelled because of "inadequate" funds, asked for at least $250 million more to "keep us qualitatively ahead" of the Russians in technical airpower progress. Included in the drive to boost the budget is an extra $100 million for Air Force research and development.

In voting the fiscal 1957 military appropriation, the Senate followed House action in killing the Pentagon's $100-million Reserve Tool Fund. The money was appropriated for fiscal 1956, was never spent. The Defense Dept wanted to carry the sum over to next year, keeping it as a "contingency" fund for emergency tool needs.

Administration policy . . .

The administration has been lukewarm toward efforts to increase the B-52 program. The policy is to stretch out production, keeping heavy bomber facilities going until a B-52 successor is developed. Present production rate is six planes monthly, will jump to 20 within 18 months. Lieut General Irvine, Air Force Deputy Chief of Staff, told the Symington subcommittee present capacity could handle a peak monthly production rate of 45 planes. Former Assistant Air Force Secretary Trevor Gardner calls the present B-52 policy "nonsense," recently told the Symington group a more advanced heavy bomber is nowhere near development.

Earlier this year, in the face of severe Congressional criticism of defense policy, President Eisenhower tagged $547.1 million on to the Pentagon's appropriation request. Almost half the sum earmarked for about 30 additional B-52's. At that time, a Defense Dept official said almost $20 million would be needed to expand Boeing production facilities—mainly for machine tools—to handle the increased output.

The latest budget hike would provide for extra production of at least 40 B-52's. There's considerable difference of opinion on how much additional capacity would be needed to handle the extra production. The matter has degenerated into a political Donnybrook.

Democratic critics say an "immediate acceleration" in output would be possible. But Republican spokesmen argue that more money does not necessarily mean more planes can be produced right now.

Will added funds be spent? . . .

It's still uncertain whether the Pentagon will actually spend all if any of the money added to its budget. There are precedents for the administration holding on to such funds. When Congress tacked on $873.2 million to the military budget in 1950—mainly for aircraft procurement—President Truman stashed the sum away in reserve. The next year, he took the money out, called it an asset, and deducted an equal amount from the budget requests. Last year, President Eisenhower took similar action when Congress added $42 million to increase the size of the Marine Corps.

Contractor blacklist . . .

A Pentagon "black list" of military contractors is under Congressional scrutiny. Listed are at least 600 firms—many metalworking—ruled "ineligible, disqualified, debarred, suspended or otherwise prohibited from entering into contractual relationship with the military services. Included are a Kansas City auto parts maker, an ordnance firm in Mechanicsville, Md, a Livingston, N J, tool maker, a Jersey City food machinery manufacturer, a materials handling equipment maker in Cincinnati.

For the most part, the companies—none nationally known—have violated federal minimum wage laws, been convicted of criminal offenses involving military procurement, or have flopped performing on previous contracts. These companies know when they are blacklisted.

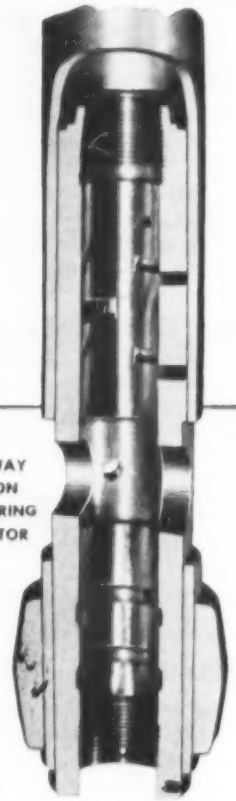
chute in foreground.

56-17

MICROHONING*

with self-dressing abrasives generates consistent *Functional Surface Finishes*

Microhoning, the low-velocity abrading process consistently produces part after part exactly to your specified surface finish requirements, because the abrasive grits always remain sharp.



CUTAWAY SECTION OF STEERING ACTUATOR

Monroe Auto Equipment Co. designed its power steering unit to withstand rugged use while maintaining sensitive control. In the final processing of the hydraulic steering actuator, Monroe chose Microhoning to obtain diametric accuracy, consistent finish and to generate geometric precision.

The rough and finish Microhoning operations removed .005" stock from an interrupted bore 1.125" in diameter and 6⅜" long.

MATERIAL AND HARDNESS: SAE 1118 steel, Rockwell 45-50C

TOLERANCES: size—.0003"
roundness and taper—.0001"

FINISH: 25 microinches or less

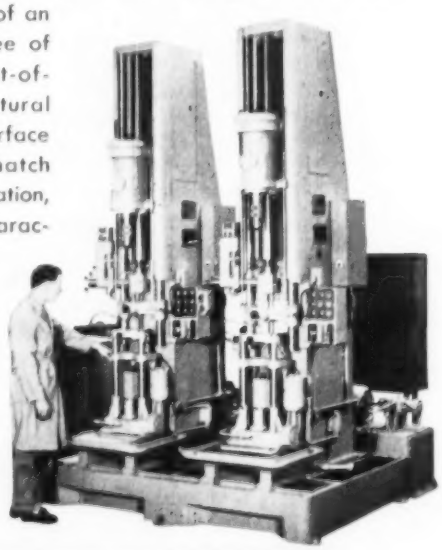
CYCLE: rough Microhoning—35 to 40 seconds
finish Microhoning—15 to 20 seconds

MACHINE: Double-column Model 740 Hydrohoner

SELF DRESSING ACTION OF THE ABRASIVES . . . is accomplished by the rotation and reciprocation of the Microhoning tool—the combined motion continuously changes the direction of force on the abrasive grits and keeps them dressed.

EFFICIENT STOCK REMOVAL . . . results from the many sharp-cutting grits acting simultaneously over a wide area of work surface. In this manner, the effect of heat is also minimized. Of all production processes, Microhoning least disturbs the sub-surface structure of the work.

FUNCTIONAL SURFACE CHARACTERISTICS . . . are obtained in one uninterrupted cycle. Microhoning generates accuracy within millionths of an inch . . . surfaces free of waviness, taper, out-of-roundness and structural stresses . . . uniform surface finish and a cross-hatch pattern for best lubrication, sealing and wear characteristics.



For more details on this application write for CROSS-HATCH Vol. 8, No. 1

*MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Detroit ... NEWS REPORT

What's in autodom's bag of tricks?

Productionwise, here's a few of the things you can look for in the not-too-distant future, according to Ford's Del S Harder. Speaking at the Ford Engineering Forum, he predicted:

(1) Strides made in improving the steelmaking process could lead to continuous casting of slabs as molten steel is taken from refining furnaces, eliminating several stages now held necessary.

(2) Aluminum will be used in automobile radiators, probably sooner than we think.

(3) These will be here soon: pressure molding of iron and steel in complex and finished shapes; moving of metal to form a part, rather than removing it by machine; bonding techniques that involve magnetizing molecules of metals: and hydraulic shipment of raw materials such as coal through pipe lines.

Autos are starting to move . . .

A solid move toward more sales is helping erase the worry lines on auto executives' faces.

General Motors, for one, has indicated it will raise its sights on July-August car output. And Ford has announced that its June sales exceeded May's by 6%, and that it will up its July production by 8%. Chrysler to date hasn't announced any intentions of upping '56 output —possibly won't because it will break with its '56 model lines earlier than most automakers.

New car inventories are sliding down favorably. If June sales, which were pegged at better than 160,000 for the first 10 days of the month, continue, June will be better than May. And it could be that the industry will at last see its inventories drop below the "magic figure" (30 days' supply) to the 700,000 car level.

Used car market is booming . . .

Used cars in the medium-priced field are outselling new medium-pricers by better than 12%. In the same period last year, new cars led used ones by about 17%. Dealers report that most used cars today are hard to get, easy to sell.

The auto production picture . . .

Suffering from a spate of wildcat strikes, Chrysler dropped off about 4000 units for the first week in June. Plymouth output was hardest hit—off 43% from the previous week.

Over at Ford, the Ford Division sagged slightly—2% or so. But Mercury, now running five full days a week at all four of its assembly units, upped its production almost 4%. Lincoln is still out in front of its 1955 levels by nearly 27%.

At General Motors, Chevrolet has produced more than a million units this model year—is still outproducing Ford at a rate of anywhere from 4000 to 5000 cars a week. Pontiac and Oldsmobile are holding to their respective production schedules of 5500 and 7500 cars a week. Cadillac hit the halfway point recently in its announced output of 156,000 units for the '56 model year.

At American Motors, Rambler shut down for the week of June 18, and Hudson and Nash went through a week's shutdown, too. Rambler, incidentally, will shortly become a separate division in the AMC lineup, with all four-door models to be built in Milwaukee—leading to the supposition that Nash and Hudson output, also in Milwaukee, will be curtailed considerably. The Kenosha plant will turn out Rambler station wagons only.

Studebaker-Packard is up slightly and the company is on a five-day production schedule. Studebaker's Golden Hawk is accounting for about 11% of total S-P sales and 28% of all Studebaker sales. The company had hoped the Hawk line would do 20% of all S-P retail sales.

End to mechanical fuel pumps?

Growing need for premium motor fuels in today's high compression engines (it'll be even greater in the '57 models) has automotive engineers predicting an industry-wide switchover to electric fuel pumps, which overcome high-grade fuels' tendency to vapor-lock easily.

Some facts about fuel injection . . .

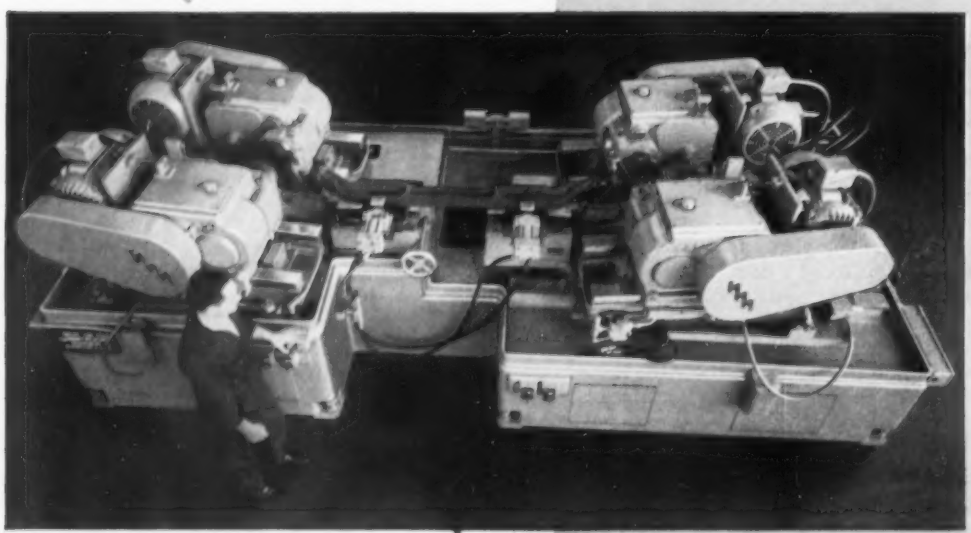
Fuel injection, long talked about in the industry (and it may be optional on some '57 cars) isn't getting much encouragement from automotive engineers. Said one: "If all automobiles now on the road had fuel injection as good as we've developed today, and somebody brought a carburetor out as good as we have today . . . we'd hail it as a major engineering achievement."

Trouble is, fuel injection doesn't do anything for the customer, say the engineers—because 90% of driving is done at speeds under 50 mph. But the engineers glumly admit that if the sales promotion and advertising boys decide fuel injection will sell cars, they'll get it.

MIGHTY BIG JOB

MINIMIZED by another

MOTCH & MERRYWEATHER *Production Solution*

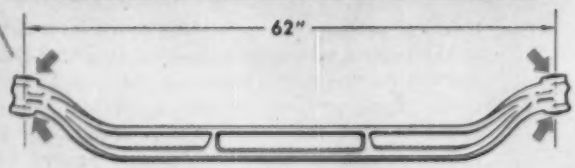


Traveling head universal double duplex milling machine.

Four faces of a part are milled simultaneously by this universal-special machine. Mill faster, more accurately, at less cost with a head for each surface. Motch & Merryweather engineers can design universatility into special equipment. Thus, machines performing a specific task can be quickly adapted to a variety of sizes. Have M. & M. study your next job with a view to broadening the usefulness of ostensibly special equipment.

Write for Bulletin S-56 describing M. & M. Duplex Milling Machinery.

YOU'RE AHEAD WITH A HEAD FOR EACH SURFACE



Operation: Milling kingpin bosses of truck axle.
Material: . . . . . Forged steel.
Brinnel Hardness: . . . . . 217-255.
Machine cycle time: . . . . . 30 seconds

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders of Automatic Precision Cut-off, Milling and Special Machinery

Machine tools ... NEWS REPORT

Ailing export market . . .

Those who expect machine tool exports to return to their former high level—a ratio of 20% of total shipments from U S builders' plants—are in for a disappointment.

This is the opinion of competent observers and of machine tool men themselves who are familiar with foreign markets.

Export sales have been jogging along at around 10%, sometimes a little less, sometimes more.

They won't do much better than that from now on, except in a war or close-to-war situation.

For one thing, Europe is now almost overflowing with machine tool builders who are selling standard machines at home and in world markets at far less than U S machine prices.

These builders too are offering liberal credit terms not matched by American builders.

With U S standard machine tools at a tremendous disadvantage abroad, there are still the high-production machines and the specials.

But even in these categories, in which American builders have not had a peer, the clear weather has given up to cloudy.

Both the Germans and the British are getting into the building of transfer-type machines for European automobile companies.

They have been given every encouragement in this direction by the European subsidiaries, such as Vauxhall and Opel, of U S automakers.

Other European automobile people, too, have placed sizeable orders for transfer machines.

Standard Motor Car Co of Coventry, England, has just installed a large number of specials during a major retooling program. Much of the equipment came from England's Archdale and Germany's Heller.

High-production machine tools that can make big savings in plants with large output still have the edge on European machines. But the edge is getting thinner all the time.

The times call for salesmanship of the highest calibre—salesmanship that embodies a real knowledge of foreign markets.

Observers and machine tool men both agree that only by the exercise of such salesmanship will U S builders be able to hold onto what they have.

Meanwhile, an increasing number of builders believe the best way to deal with the situation is to manufacture their machines abroad, or to license foreign companies to do so.

Buildup in AF idle tools . . .

Air Force's idle machine tool inventory will consist of an average of 62,000 units a month in fiscal 1957 (started July 1). This compares with 47,000 units this year. The "phasing out of production" on various projects is responsible for the increase.

Some $17 million is being sought by the Air Force to store, maintain and repair the equipment. That is $1.4 million more than in '56.

In the past six months, the Air Force has acquired 163 machines from the services and GSA.

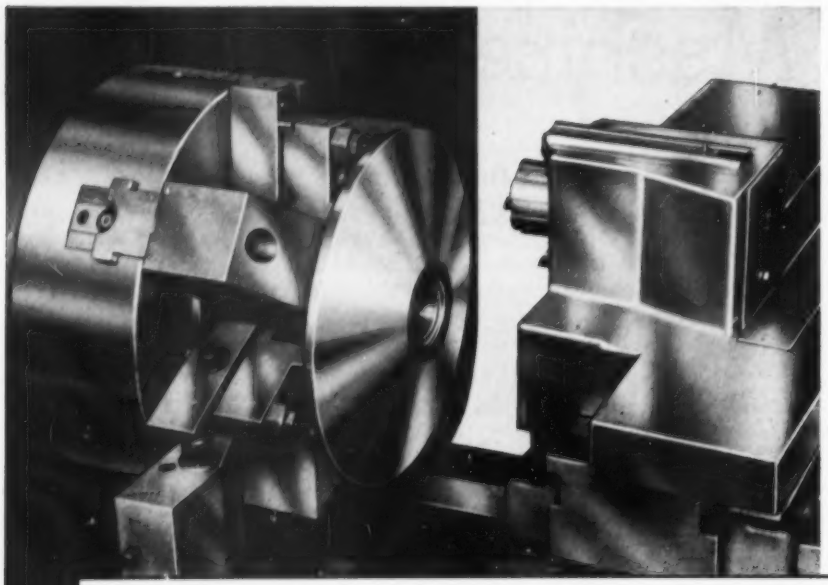
Meanwhile, 1146 idle Air Force machine tools were shipped to Air Force, Army and Navy contractors.

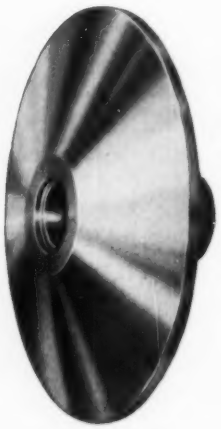
The armed services are being pushed hard by Congressmen to give assurances that they are not buying types of equipment already stored.

Pentagon went on record to the effect that recent screenings for facilities expansion projects indicate that the amount of idle equipment put to use in the first half of 1956 exceeds that of the previous six months.

NOW BASED ON DOLLAR VOLUME, rather than on the previous base-year index of 1945-1947=100, the National Machine Tool Builders' Index shows that net new orders rose from $78.5 million in April to $87.4 million in May, and that shipments went up, too—from $71.8 million in April to $76.6 million in May

ARE YOU REALLY POWERED FOR PRODUCTION?



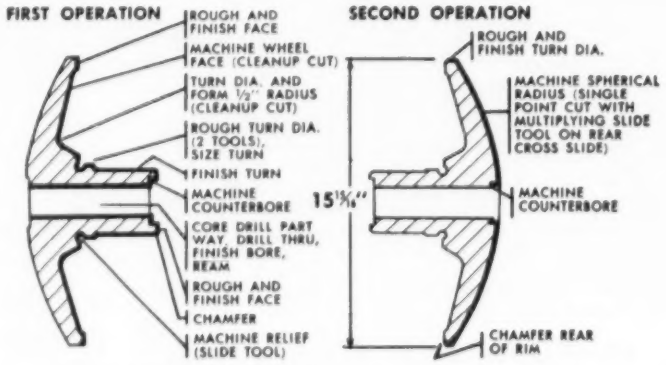


A POTTER & JOHNSTON 4-U Automatic Chucking Turret Lathe can produce a part like this every 19.1 minutes!

PART: Transmission Wheel

MATERIAL: Nitralloy Steel Forging

REQUIRED: 2 Operations, a Total of 23 Separate Cuts including 2 Radii and a Relief Cut


FIRST OPERATION
ROUGH AND FINISH FACE
MACHINE WHEEL FACE (CLEANUP CUT)
TURN DIA. AND FORM ½" RADIUS (CLEANUP CUT)
ROUGH TURN DIA. (2 TOOLS), SIZE TURN
FINISH TURN
MACHINE COUNTERBORE
CORE DRILL PART WAY, DRILL THRU, FINISH BORE, REAM
ROUGH AND FINISH FACE
CHAMFER
MACHINE RELIEF (SLIDE TOOL)
SECOND OPERATION
ROUGH AND FINISH TURN DIA.
MACHINE SPHERICAL RADIUS (SINGLE POINT CUT WITH MULTIPLYING SLIDE TOOL ON REAR CROSS SLIDE)
15 15/16"
MACHINE COUNTERBORE
CHAMFER REAR OF RIM

HEAVY LINES INDICATE MACHINED SURFACES

CAN YOUR PRESENT EQUIPMENT MATCH THIS PERFORMANCE?

Check your production records. If they don't measure up to the example shown above, you're missing important opportunities for faster output and bigger profits. It takes a truly modern machine like the P&J 4-U – with the extra power, speed, rigidity and versatility needed to handle tough alloys and complex cuts – to compete profitably in today's markets. You can't *afford* second-best equipment . . . so write now for full information on the finest. Ask for P&J Bulletin No. 158 describing the Potter & Johnston 4-U Automatic and including complete engineering data.

Precision Production Tooling for more than Fifty Years

POTTER & JOHNSTON COMPANY

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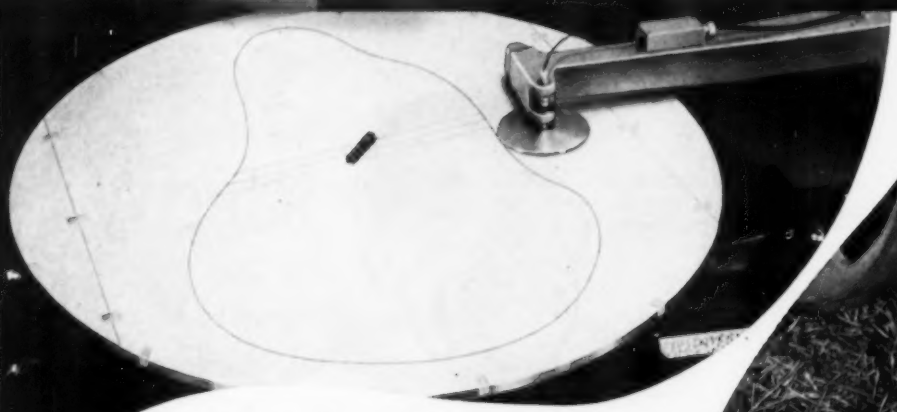
SUBSIDIARY OF PRATT & WHITNEY COMPANY, INCORPORATED

MODERNIZE WITH POTTER & JOHNSTON . . . REPLACE FOR PROFIT



Here, the non-contacting tracer follows the large-scale contour drawing easily prepared with electrically conductive "ink." For this job, a 10:1 drawing-to-workpiece reduction ratio is used, but any desired scale such as 20:1 or higher can be selected.

Following the action of the tracer, the cutter reproduces the exact shape of the drawing on the workpiece. Due to the selected reduction ratio, any errors in the drawing are reduced in the same proportion; resulting in accurate milling or grinding.

mill or grind IRREGULAR CONTOURS *without* expensive models *or* complex special tooling

- **mill or grind directly from simple line drawings**
- **extremely accurate**
- **unique, non-contacting tracer control**

MODEL 104 *Electronic* CAM and TEMPLATE MACHINE

If you are producing external or internal cams, templates, blanking punches or dies of complex, irregular shape, here are important opportunities for greater accuracy, shorter production times and lower costs than ever before possible! Send for your copy of Circular No. 579-1 fully describing the Model 104 Cam and Template Machine. Or, write to West Hartford on your Company letterhead outlining your requirements. Manufactured by the New England Machine & Tool Company. Sales representation by Pratt & Whitney.

Manufactured by the New England Machine & Tool Company. Complete sales engineering and maintenance service through Pratt & Whitney

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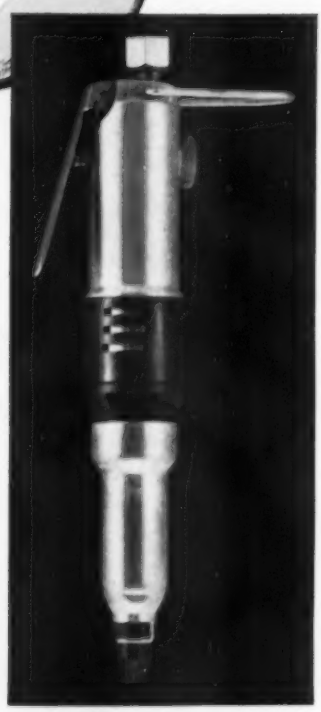
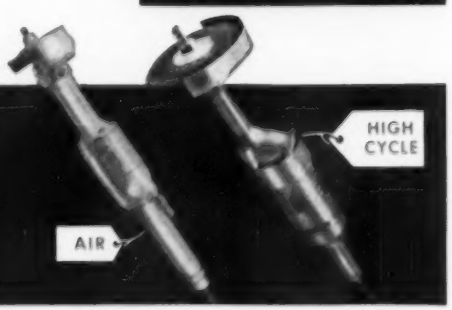
New Rotor "02" Nutsetter cuts job time 50%

Nutsetters here, on radio chassis assembly, operated at 1200 rpm. Changed to Rotor S-02 LC Air Nutsetter . . . operates at 2500 rpm and handles easier. Cut time in half. Savings paid for Rotor tool in 7 weeks. Let's see what we can do for *you* with the new Rotor tools! Ask for Bulletin 46.





THE ROTOR TOOL CO.
CLEVELAND, OHIO
UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

What's ahead ... in Metalworking

NEWS REPORT

Critical third quarter begins . . .

Prospects that the third quarter will be weakest of 1956 still persist, but slackening will be confined to a few industries.

Steel output was strong through June, with customers pressuring the mills for delivery before critical June 30 date. With a price hike certain, strike or no strike, finished steel in inventory is like money in the bank.

Slackening in steel demand seems sure for the next few months if production is uninterrupted. Production sheets are still easing, but plates and structurals remain tight.

Steel output was close to 63 million tons for the first half of 1956, is expected to run about 15% less in the second half. This adds up to 117 million tons, about the same as last year.

No drop in capital goods . . .

Sparked by record capital spending (*AM*—May 21 '56, p162), the only drop in third-quarter production is likely to be that caused by vacation closings and shortage of steel plate.

Construction machinery orders are 25% ahead of last year for the first half. Outlook is for continued high production in the second half.

Electrical apparatus will run about 10% above last year (it was up 8% in the first half). The industry is booked solidly through next year and new orders are still at a high rate.

Railroad equipment will do even better in the second half. First half of '56 saw 33,000 freight cars produced, double the '55 rate. Unfilled orders are four times the level a year ago, though down slightly from last winter.

Office machinery bookings are running 25% above last year. Both orders and shipments are expected to rise in the second half, for the best year on record.

Industrial heating volume of $200 million by 1965 was forecast by Earl Cunningham as GE opened new $5 million plant at Shelbyville, Ind. Present volume of the industry is about half that.

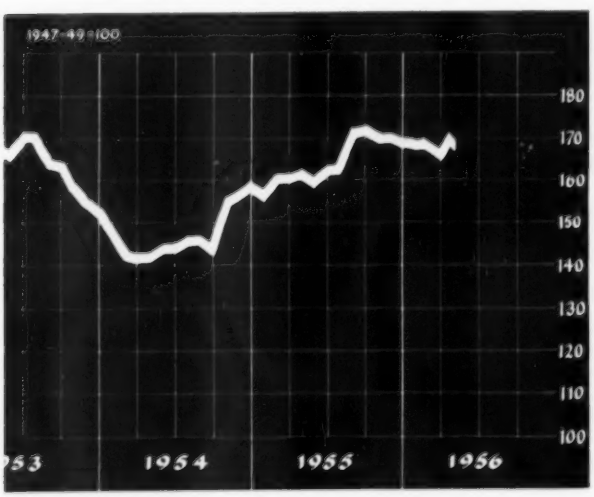
These are the soft spots . . .

Plight of the auto industry has attracted the most attention—and things don't look any better for the next quarter. Pickup is looked for only after new models are introduced.

Farm machinery builders are depressed. Feeling is that industry is in much worse shape than the auto industry. Despite first half production 10% below 1955's relatively low rate, inventories have built up. Recent gains in farm prices improve the outlook, but are not likely to show up in implement sales this quarter.

Electrical appliances have cut back recently to unload inventories. Disposable income is at record levels and output could rebound if the "hard-sell" program is successful.

Radios are off 5%, television sets 15% for the first half. Clock and portable radios are up, but this rise is more than offset by declining car radio sales.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

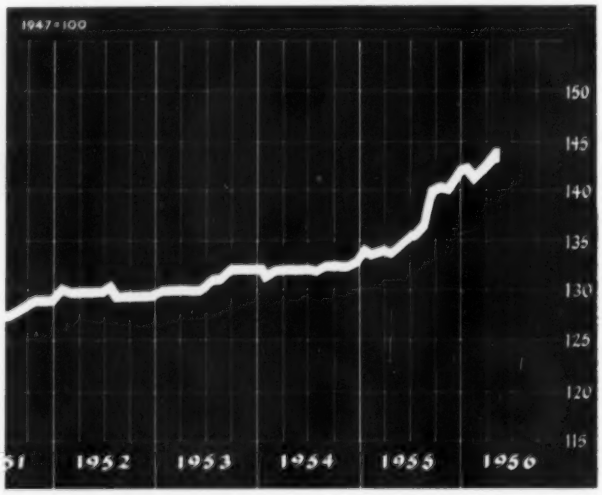
	JUNE Estimated	MAY Preliminary	APR Revised	MAY Year Ago
Total Index.	**167**	**168**	**171**	**162**
Machinery	**150**	**151**	**134**	
Electrical Machinery	**206**	**209**	**184**	
Autos	**116**	**129**	**157**	
Other Transportation	**314**	**308**	**278**	
Other Metalworking	**141**	**140**	**135**	

NEWS REPORT

What's ahead . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JUNE Estimated	MAY Preliminary	APR Revised	MAY Year Ago
Total Index	**143.8**	**143.7**	**143.5**	**134.7**
Metalworking Machinery		164.9	164.3	149.0
Other Machinery exc. Electrical		150.7	149.5	139.5
Electrical Machinery		141.2	141.2	131.7
Fabricated Metal Products		137.5	137.8	130.8



Outlook: a slow third and a fast fourth quarter . . .

It's now generally conceded that business in general won't be as good in the third quarter as it was in the second, which turned out to be a good one in spite of the automobile industry's drastic slump and continued doldrums in the farm equipment industry.

Slowdowns in those industries were offset by impressive gains in the capital goods industries, particularly in machine tools and construction machinery—a good sign that business has plenty of confidence in the future.

Today's business outlook is peculiar, to say the least. For example, the U S Gross National Product continues to reach new peaks with every passing month. Consumer income is at all-time highs, and it's still going up.

On the other hand, more businesses are reporting slackoffs than at any time since 1954. And you can look for further drops in automotive output in steel consumption in the third quarter.

New orders aren't keeping pace with deliveries —a sure sign that inventories will start to pile up as they did back in 1954.

Add up all those factors and the third quarter becomes a period of business readjustment. Economists are confident that the worst of business regearing will be over by the time the fourth quarter arrives, because the usual summer slack periods will be over—and the automobile makers will have some pretty fancy '57 models in the showrooms by then to give the economy a shot in the arm.

The elections may have a lot to do with it, too. Quite a few firms are marking time until they find out just what the business climate is going to be for the next four years.

But that question and a lot of others will be resolved by year's end. And from here it looks like a good fourth quarter will offset a slow third. Result: a "good" 1956.

WEEKLY BUSINESS INDICATORS

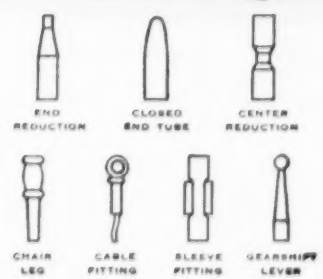
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	145.7	146.7	142.6
Steel ingot operation (thousands of tons)	2,355	2,299	2,292
Electric power output (million Kilowatt hours)	11,425	10,951	9,987
Production of automobiles and trucks	135,994	139,255	178,475
Engineering construction awards (Eng. News-Record—millions)	$443.5	$511.9	$412.1

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	142	143	138
Index of durable manufacturers' production (1947-1949=100)*	158	160	153
Durable goods manufacturers' sales, millions*	$13,492	$13,294	$12,805
Machinery manufacturers' sales, millions*	$ 3,731	$ 3,630	$ 3,193
Durable goods manufacturers' new orders, millions	$13,679	$13,337	$12,879
Machinery manufacturers' new orders, millions	$ 3,986	$ 3,877	$ 3,179

* Seasonally adjusted.

For tapering, sizing, reducing and forming to special shapes of round solids and steel tubing, the Etna Swaging Machine offers the ultimate in modern machine design. Regardless of size and description of the job to be done, there's an Etna swager right for *greater production*. Write today regarding your specific job problems.



It's New! Get full information on the blending into the wall of I. D. Bead on steel and stainless steel tube with Etna Swagers resulting in mirror finish. Bead also removed on conduit.

Abbey ETNA Company

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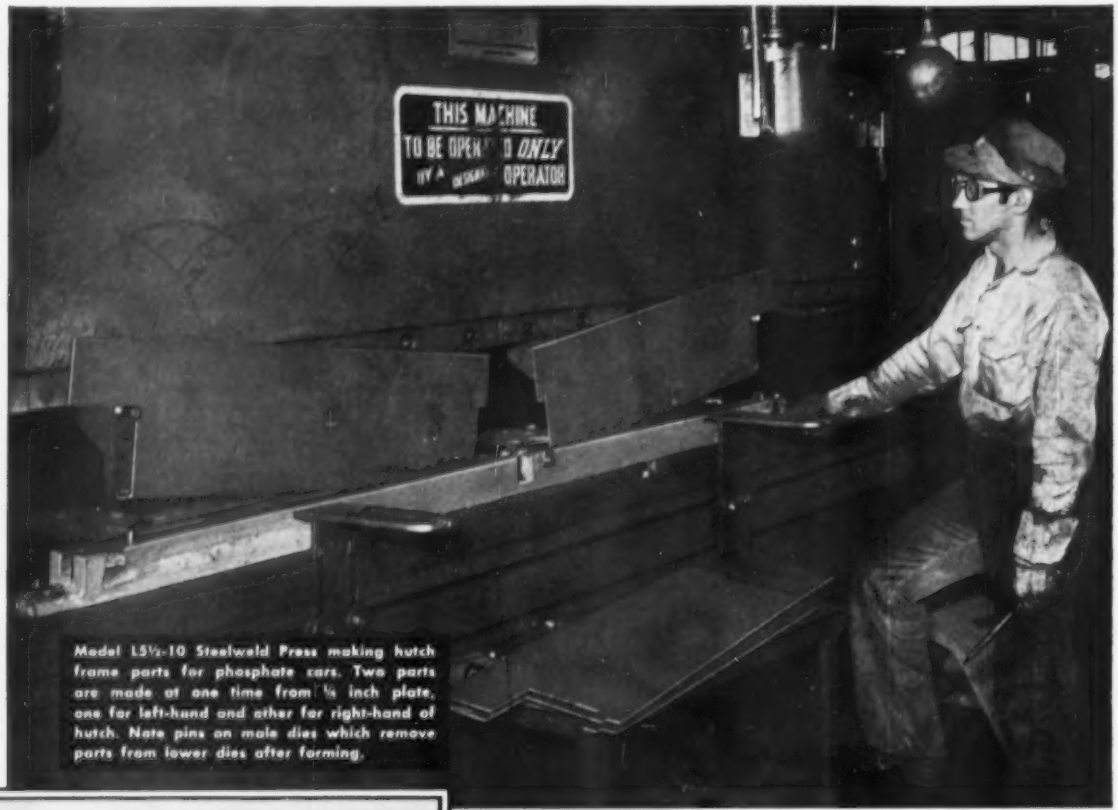
PULLMAN-STANDARD FINDS MANY USES FOR STEELWELD PRESS



Model LS½-10 Steelweld Press making hutch frame parts for phosphate cars. Two parts are made at one time from ¼ inch plate, one for left-hand and other for right-hand of hutch. Note pins on male dies which remove parts from lower dies after forming.

A few of the many parts produced within a short period on the Steelweld Press. Curves and bends of every shape and degree are formed quickly and accurately.

"The more we use our Steelweld Bending Press, the more we learn about what it can do for us", said the Day Superintendent of Pullman-Standard Car Mfg. Co., Butler, Penna. "As a result it is handling more and more of our work. We are doing a great many forming jobs on it that did not occur to us as being possible when we first installed the machine."

An endless variety of parts are produced on this press. These are mostly of ¼ and ⅜ inch steel plate and involve curves and bends of every description for gussets, fulcrums, braces, frames, housings, etc. used in the manufacture of railroad cars.

The dies used are relatively simple and made in the company's shop. Because dies are easily changed, it usually takes about an hour to set up for a new job.

If you work with metal plate in any thickness up to one inch, for bending, forming or punching, you should get the facts on the many features of Steelweld Presses.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

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BENDING PRESSES

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

They have never had it so good

London, England
June 25, 1956

London has changed. The drabness, the rubble, the sombreness, the austerity that began in war days and extended up through 1952 have largely vanished.

Signs of the change, first evident two years ago, are all around. Many new buildings have been erected. Even a skyscraper is to go up on the south bank of the Thames. There has been a general clean up and paint up, with gay patches of color enlivening the scene.

Streets and store windows are brightly lighted at night. People are better dressed, look cheerful and obviously have money to spend. They have been spending it for goods that for a long time were reserved exclusively for export. The British are traveling in a big way "on holiday"—by bus, by train, by private car.

This prosperity penetrates deeply . . .

into the economy, and nowhere is it more impressive than in Metalworking. The automobile industry has been expanding facilities as car ownership comes within the bounds of more and more Englishmen and as the export market grows too. About 25% more cars are on the road than a few years ago: and the clamor for more and better highways is mounting. Even a few motels have sprung up as a curious anomaly alongside old English inns.

True, British automobile companies have been hit this year by a drop in demand similar to that in America, but the setback is viewed as temporary and the next few years loom pleasantly.

The heavy-goods industries have been operating at or near full capacity and order books are comfortably loaded for a long time ahead. The machine tool industry has a backlog that stretches out to somewhere between one and two years. What's more, the home demand has been terrific.

Never have the British had it so good. It has been so good, in fact, that the government has become concerned about the possibilities of inflation. Too much production is being consumed at home and not enough is going abroad, thus creating an unfavorable trade balance.

So the Exchequer felt forced . . .

recently to put a bit of a curb on the Britisher's rampant spirits. Certain tax incentives, for one thing, have temporarily been withdrawn in an effort to reduce and control the torrent of money being poured into new plant and equipment.

Perhaps most interesting of all, wage rates have been going up steadily. Another round of wage negotiations has been in progress. Middle-class incomes are averaging more than ever before. Unless the trend is reversed—and that seems unlikely—the British are heading into an era when mass buying power may be great enough to permit the average Englishman to purchase and enjoy the luxuries of everyday living so commonplace in America but up to now so thinly distributed in the United Kingdom.

If this should happen . . .

it could transform the British economy in the next decade and contribute importantly to a continuing and growing prosperity.

Yes, it is a changed London and a changed England. It is a heartening experience to see the transformation and to observe at work the underlying forces that give promise that the new conditions are here to stay.

Burnham Finney EDITOR

...this modern CINCINNATI PRESS BRAKE...

gets the orders...

at MARION MACHINE FOUNDRY & SUPPLY CO.
Marion, Indiana

This Cincinnati Press Brake immediately produced orders in a highly competitive jobbing market.

A $25,000 job, which previously would have been lost, was profitably handled. A 3" channel with 2¾" flanges was formed in six gauge material.

Investigate these modern design features for low cost production.

- Centerline loading
- Rigid, All-Steel Construction
- Deep beds and rams
- Interlocked construction
- Large, high strength radii—free of weld
- Ram elevation—complete with micrometer indicators
- Tilting ram adjustment

Write for Cincinnati Press Brake Catalog B-4

Photos courtesy the Marion Machine, Foundry & Supply Company, Marion, Indiana.

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American Machinist

How tool design affects cutting forces

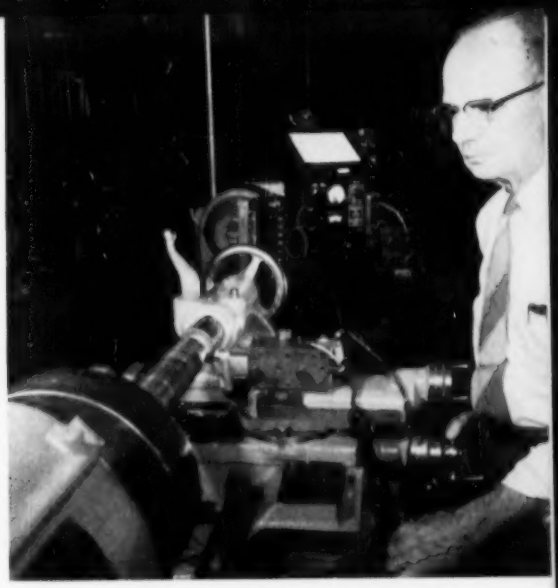

FIG. 1 . . Dynamometer set up in the laboratory for measuring three components of cutting forces

Chipbreaker design, rake angles, and direction of grinding marks all influence the horsepower required for cutting. Just how much in each case is revealed by a special 3-element dynamometer that handles vertical toolholders with triangular insert blanks

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Dynamometer tests show that each component of the cutting force required in single-point turning is increased by the use of negative rakes. The direction of the grinding marks in relation to chip flow and the design of chipbreakers are also factors.

These conclusions are among those that came from a series of tests of clamped and brazed carbide tools. A Vascoloy - Ramet vertical toolholder with triangular insert blanks with clamped chipbreaker, and carbide tips brazed to steel shanks were used in the tests.

Cutting Components

Cutting load on a single-point lathe tool may be resolved into three principal components: 1, tangential force which deflects the tool downward, also called cutting force; 2, longitudinal force which deflects the tool toward the tailstock, also called feed force; 3, radial force which tends to push the tool away from the work. Depending on the design of the tool, the radial force may act either away from the work or toward the work.

Table I shows the geometry of the tools tested. Where two tools of the same geometry were tested, one had the grinding marks turned so that chip flow was parallel to the marks, the other had chip flow perpendicular to the marks.

Tests were made with SAE 1045 steel, heat-treated to 229 Brinell. All cuts were made at 230 sfpm, depth of cut 0.100 in., feed 0.010 ipr. Tests were in an 18x30-in. Monarch lathe.

Each cutting test result shown in Table III is an average of at least five readings, although the individual readings using this dynamometer never varied more than 3% from the average value.

Graphic comparisons of some of the test results are shown in the bar charts. In

Table I . . GEOMETRY OF TOOLS TESTED*

Tool No.	Type	Back Rake, degrees	Side Rake, degrees	Side Cutting-Edge Angle, degrees	Type of Chip Breaker**	Depth, in.	Width at Point, in.
1	Clamped	−7	−7	15	Clamped-Parallel		5/32
2	Clamped	−7	−7	15	Clamped-Parallel		5/32
3	Clamped	0	0	15	Clamped-Parallel		5/32
4	Clamped	0	0	15	Clamped-Parallel		5/32
5	Brazed	−7	−7	15	None		—
6	Brazed	−7	−7	6	Angular 15°	0.020	1/16
7	Brazed	0	0	6	Angular 15°	0.020	1/16
8	Brazed	−7	+7	6	Angular 15°	0.020	1/16
9	Brazed	−7	+7	6	Angular 15°	0.020	1/16

*All tools had end relief of 7°, side relief of 7°, end cutting-edge angle of 15°, and nose radius of 3/64 in.
**Type of chip breaker shows angle with side cutting-edge angle.

Components of cutting forces shown by dynamometer tests
(F_T = tangential, F_L = longitudinal, F_R = radial)

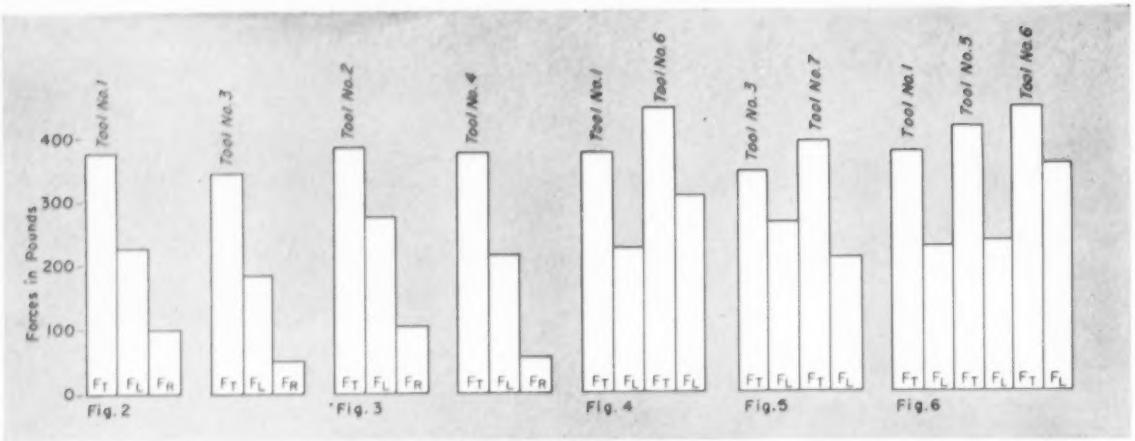

FIG. 2 . . Tool 1 had negative rakes, Tool 3 had neutral rakes, both had clamped chipbreaker and grinding marks perpendicular to chip flow. **FIG. 3** . . Tool 2 had negative rakes, Tool 4 had neutral rakes, both had clamped chipbreaker and grinding marks parallel to chip flow. **FIG. 4** . . Tool 1 had clamped chipbreaker, Tool 6 had ground-in chipbreaker, both had negative rakes and grinding marks perpendicular to chip flow. **FIG. 5** . . Tool 3 had clamped chipbreaker, Tool 7 had ground-in chipbreaker, both had neutral rakes and grinding marks perpendicular to chip flow. **FIG. 6** . . Tool 1 had clamped chipbreaker, Tool 5 had no chipbreaker, Tool 6 had ground-in chipbreaker, all had negative rakes

Fig. 2 comparison is made of tangential, longitudinal, and radial forces in tools 1 and 3. No 1 was a carbide insert in the vertical toolholder with 7° negative back and side rakes. No. 3 was a similar tool with neutral rakes. Forces are higher with the negative rakes: tangential force is up 8.4%, longitudinal force is up 25.2%, and radial force is up 100%.

Similarly in Fig. 3, tools 2 and 4 are compared. Increase for the three forces in the negative rake tool are 2.4%, 9.4%, and 90.5%.

The bars in Fig. 4 compare tools 1 and 6, both with 7° negative back and side rake angles, but No. 1 has a clamped chipbreaker and No. 6 has a ground-in chipbreaker. The difference in cutting forces in favor of No. 1 may be caused by the tightness or the shape of the chipbreaker or it may be attributed to the difference in the side cutting-edge angles of the two tools.

Fig. 5 provides a similar comparison between tools 3 and 7, which have neutral rake angles, with the same result. In both of these cases the chip curls gracefully away from the face of the tool with the clamped chipbreaker and exerts a pressure against the shoulder of the chipbreaker before curling up more abruptly in the ground-in chipbreaker.

Another example is seen in Fig. 6, comparing tools 1, 5, and 6. All have negative back and side rake angles, but No. 1 has a clamped chipbreaker, No. 5 has no chipbreaker, and No. 6 has a conventional ground-in chipbreaker. We would expect No. 5, with no chipbreaker, to have the lowest cutting forces, but this is not the case. The clamped chipbreaker has the advantage. However, there is one other factor involved in this example: direction of grinding marks.

Grinding Marks

Effect of grinding marks on the components of cutting load can be

Table II . . SURFACE FINISH OF TOOLS

Tool No.	Parallel to Grinding Marks mu in., rms	Perpendicular to Grinding Marks mu in., rms
1	6 to 10	—
2	—	15 to 20
3	2 to 3	—
4	—	10 to 20
5	6 to 10	10 to 25
6	6 to 15	—
7	6 to 15	—
8	6 to 15	—
9	6 to 15	—

Table III . . SUMMARY OF CUTTING TEST RESULTS

Tool No. and Grade	Tangential F_T, lb	Longitudinal F_L, lb	Radial F_R, lb	F_L/F_T %	F_R/F_T %
1-EM	375	228	100	58.2	26.8
2-EM	387	233	101	60.2	26.1
3-2A7	346	182	50	52.5	14.4
4-2A7	378	213	53	56.5	14.1
5-E	411	236	—	57.6	—
6-EM	447	307	—	68.6	—
7-EM	394	212	—	53.8	—
8-EM	368	154	—	41.8	—
9-EM	366	158.7	—	43.4	—

seen by comparing Fig. 2 and 3. The two tools in Fig. 2 had the tips set so grinding marks were approximately parallel to the side cutting edge, thus the chip was sliding perpendicular to the marks. The two tools in Fig. 3 had the inserts placed so the chip was sliding along the grooves left by the grinding wheel.

Differences in the cutting forces are not great because all tools had a reasonably fine finish, but the difference is in favor of the tool with chips flowing over the top of the tool marks. In Fig 6, tool 1 has a clamped chipbreaker, but it also had grinding marks perpendicular to chip flow. Tool 5 had no chipbreaker and grinding marks parallel to chip flow. The two factors probably combine to produce the lower cutting forces for tool 1.

Conclusions

The horsepower required to cut materials is dependent primarily on the tangential component of the cutting load. These tests indicate that this component is only 8.4% higher, for the type of cut tested, with 7° negative rake angles than for zero rake angles. The difference is much greater percentagewise for the other two components of force.

The clamped chipbreaker was found to be superior to either no chipbreaker or a ground-in chipbreaker. Undoubtedly a chipbreaker ground to the same configuration as the clamped chipbreaker would produce similar results.

Finally, direction of grinding marks has an effect on cutting force. If the marks are shallow, this effect diminishes. This may throw some light on the preference for lapping carbide tools. Also, some shop men grind single-point cutting tools so grinding marks will be parallel to the side of the tool.

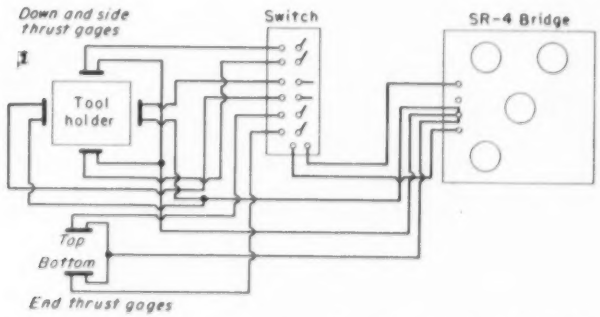

FIG. 7 . . Gage connections for measurement of cutting forces through switching device

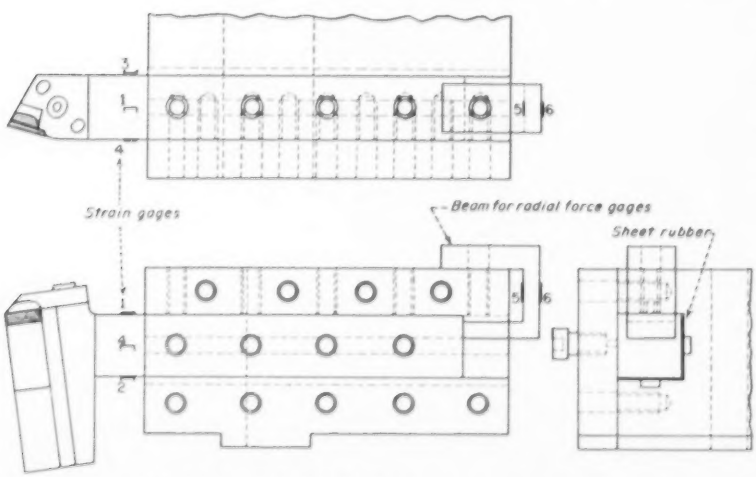

FIG. 8 . . Mounting block for vertical toolholder showing location of strain gages

A TOOL DYNAMOMETER FOR CLAMPED TOOLHOLDERS

To measure the three components of cutting load when cutting is done with carbide inserts clamped in a vertical toolholder, it was necessary to make a dynamometer of the toolholder (a tool dynamometer large enough to handle the toolholder was not available in the laboratory).

A toolblock was machined to take the toolholder. With this block clamped in the compound rest of the 16-in. lathe, the toolholder is a cantilever beam subject to deflections, hence to strains, when cutting loads are applied.

These strains were measured with Baldwin SR-4 electric strain gages, made of cupro-nickel, cemented with nitro-cellulose cement to the shank of the toolholder.

The strain gages form part of a balanced Wheatstone bridge. When the tool shank is deflected, the gages are stretched or compressed. This distortion alters the electrical resisance, upsetting the balance of the Wheatstone bridge. Balancing the bridge with a variable resistor calibrated in microinches of deflection permits readings under strained and unstrained conditions. The instrument is calibrated by applying known forces.

Because of the large cross-section of the toolholder shank in relation to the intensity of the radial force encountered, the compressive strain or distortion was small, producing readings of doubtful reliability when the strain gages were mounted directly on the tool shank.

For this reason, strain gages for measurement of radial force were mounted on a separate beam at the rear of the toolblock. The slot in the toolblock was made wide and high enough to permit insertion of a thin sheet of rubber on the side and bottom of the toolblock slot. The toolholder was clamped by screws with ends turned down to a pencil point. This design permitted some deflection of the points of the screws under radial force, transmitting radial thrust to a more sensitive beam at the rear of the toolblock.

The dynamometer was recalibrated. Under repeated tests it was found that the tangential and longitudinal forces were of the same magnitude as before, but the radial force was now easier to obtain through the magnified deflection of the separate beam.

Centralized coolant filtration
• cuts tool cost
• increases production 15%

Used on cutting fluid for turret lathes and automatic screw machines, this filter system will pay for itself in one year of two-shift operation. The key is to remove the "fines", the particles under 25 mu-in.; thus minimize edge buildup and abrasion. Permits higher cutting speeds too.

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Instrument manufacture is a highly competitive business. The margin of profit is small. Work is to close tolerances. Fine finishes are essential. Tough and unusual materials are commonplace. Frequently, job lots are small and each part in process represents a sizeable investment. Management cannot risk investment in equipment without positive assurance of a return.

One answer to meeting this challenge, and prospering, is to analyze the basic productive ability of each machine and process; then use and supplement these advantages for maximum benefit. At Taylor Instrument this program is underway. We are replacing old and obsolete machines as rapidly as we possibly can. Eventually, none of our machine tools will be more than ten years old. Also, full advantage is being taken of the increased facilities made possible by some of the new attachments and accessories.

Part of this program is methods evaluation to discover the "break-even" point for each operation. This study includes quality control, man-machine capability, maintenance, and a variety of other factors. For instance, higher speeds can mean better finishes—and at the same or heavier feeds, production goes up.

Our studies showed that when we used our newer, more-accurate, and better-maintained machines, much higher speeds were possible. In several cases, we are machining stainless steel at more than 1000 sfpm. In addition, we can work more accurately and with less scrap. So far, each process improvement has been rewarding.

As cutting speeds are increased, and finish requirements get tighter, tool life begins to suffer. One of our first over-all problems was to increase the time between grinds for the cutting tools. We studied tool materials, tool geometry, the relationship between feeds and speeds, and a variety of coolants. None of our findings produced any major improvement except that new, clean, cutting oil gave longer tool life than recirculated fluid.

Then we heard that one of the large bearing manufacturers was having outstanding results with filtered coolant on automatics. While filtration is common for grinders, it is extremely rare in machines using cutting tools. We contacted this company and it was extremely cooperative in allowing us to visit the plant to discuss the installation.

For our kind of product, finishes and accuracy are more important than maximum stock removal. Anything that boosts speed is important to permit fine feed at the best possible stock removal. Also, because so much of our work requires fine feeds, more "fines" are produced in cutting and introduced into the coolant. We are convinced that these "fines" are a major detriment to tool life.

During our studies, we noticed that a tough job would run without trouble for about one week on a machine thoroughly cleaned in advance and supplied with new coolant. Then tool life would drop off rapidly and all kinds of trouble would start. When the machine and sump were thoroughly cleaned and the cutting oil was completely changed, the job ran smoothly again.

Following this path, we developed a list of the manufacturers of filters and then contacted each of them. To simplify our effort we narrowed the list to

FILTRATION SYSTEM is housed in prefab, fireproof building at left —on roof of plant. This location adds to the safety of the installation and it avoids using valuable space in the plant

COOLANT SUPPLY AND RETURN is provided by a network of pipes placed just above the floor between rows of machines arranged back to back. Placing pipes above the floor, rather than in trenches, meant lower installation cost plus much greater flexibility. Dirty-coolant return pipe is sloped to aid in carrying oil to sump in floor

cartridge filters, centrifugal separators, paper filters, cloth filters, and pressure filtration, using diatomaceous earth as a filtering medium.

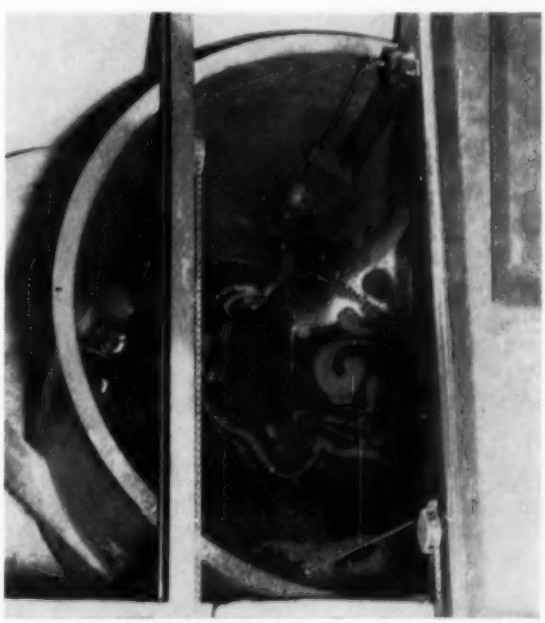
First we tried individual cartridge filters on each machine. These convinced us that filtration would improve tool life—and for a shop with only a few machines they might be sufficient. However, to meet the demand in our plant, cartridges cost $32 per day per machine. A single cartridge would load in four hours.

We analyzed the use of centrifugal separators, paper filters, and cloth filters. None of these was considered because of high maintenance cost and flow problems.

We were told that we could remove the fines by settling them out in a tank. To check this, our metallurgical laboratory used test tubes to conduct an extensive series of settling tests. Particles under 25 mu in. did not settle out to any useful extent in less than 48 hours. We were convinced that for any efficient removal they must be filtered out.

In another test we had a small pressure filter installed on a trial basis. This equipment gave us what we wanted, hence we designed an installation capable of supplying the needs of all of our turret lathes, automatics, and screw machines. This totals about 100 machine tools. This system has proved to be most economical from the standpoint of initial installation, operating expense, and maintenance. It removes micro-particles as small as 5 to 10 mu in. at a practical flow rate.

However, this enthusiasm is never enough for Management. To get approval for the expense of this installation, sound reasons were required. Here are



ONE OF TWO COLLECTING SUMPS for dirty cutting oil. Sumps are on opposite sides of the shop and below the floor level. From here oil is pumped to filtration unit on roof of plant. Signal-connected floats warn if level in sump becomes too high. The two sumps will hold the surplus oil in the system if valves fail

Centralized coolant filtration . . .

the reasons we gave:
1. Estimated 15% increase in tool life.
2. Estimated 10% increase in productivity.
3. Saving on cutting oil of 3000 gal per year at 75¢ per gallon.
4. Using dual-purpose oil for cutting and lubrication we could save 2000 gal of lubricating oil at 50¢ per gallon.

HERE ARE RESULTS

On this basis, Management approved the installation and, after one year of operation, here is the result:
1. Tool life has been increased 30%.
2. Production on these machines is up 15%.
3. We are saving more than $3000 per year on cutting and lubricating oil.
4. We were cleaning sumps every 3 to 4 weeks, using approximately 16 hr of labor per month. Now they are cleaned once every 4 months using a flushing system at less than 25% of the original cost.
5. The machines run longer between tool grinds.
6. Loss of parts from tool-wear tolerance loss is minimized.
7. Our tool-grinding staff has been reduced 1/3—a saving not even in the estimate.
8. The operator runs production longer—makes more units per shift. The operators have been enthusiastic about working with clean coolant.
9. Roughly speaking, this installation cost us the price of two automatics. By broadening and improving the performance of all of our lathe equipment it has given us the ability to absorb considerably more work with the same facilities, floor space, and personnel.
10. We have had a sizable reduction in our tool inventory.

The increase in cutting speeds, with its inherent improvement in the control of finish, accounts for 10% of the production increase. One job was jumped from 93 pc per hr to 140 pc per hr.

At present, our system provides 225- to 250-gpm capacity of 150-viscosity, 100°-Seybold cutting oil. We are using a high-sulfur oil compounded to a viscosity of 150. Normally, this oil has a viscosity of 175 to 200, but we have it compounded to 150 so it is the same as spindle oil. Clean oil from the refinery is used for machine lubrication. After draining, it is run into the sump for use as cutting oil.

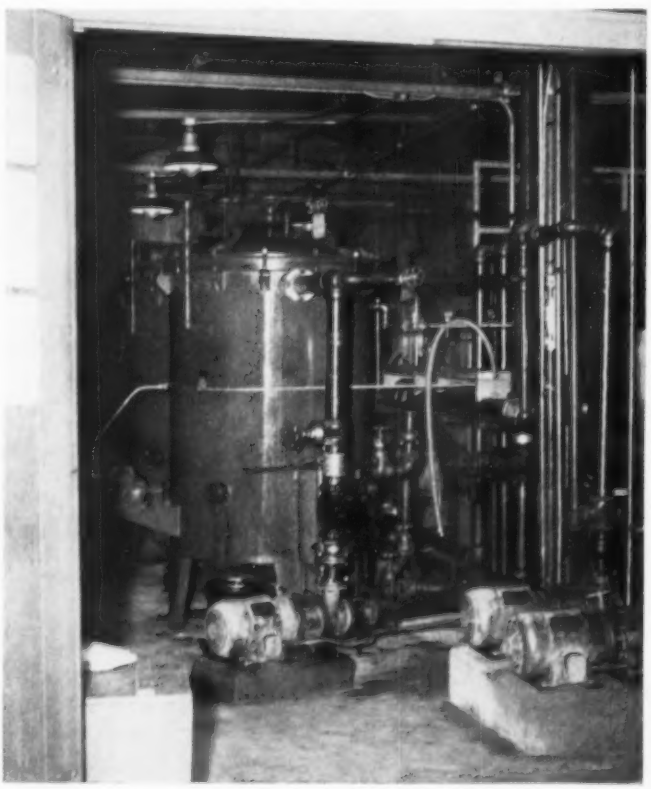
Basically, ours is a short-run shop. There is a sizable advantage to not removing and replacing cutting oil at frequent intervals. This oil has proved satisfactory for most operations. When carbide is used, the system is shut off and this oil is replaced with soluble oil from an individual tank.

One of the interesting tricks of the system is continual sump flushing. The bottom of the sump on each machine was given a layer of concrete sloped to angle the flow to one end of the sump. A small inlet from the pressurized clean-oil line at the upper end flows oil continually over the bottom. Also, during installation a bypass pipe was connected between the clean line and the dirty (drain) line. Thus, clean oil at 20-lb pressure can be used to flush the system.

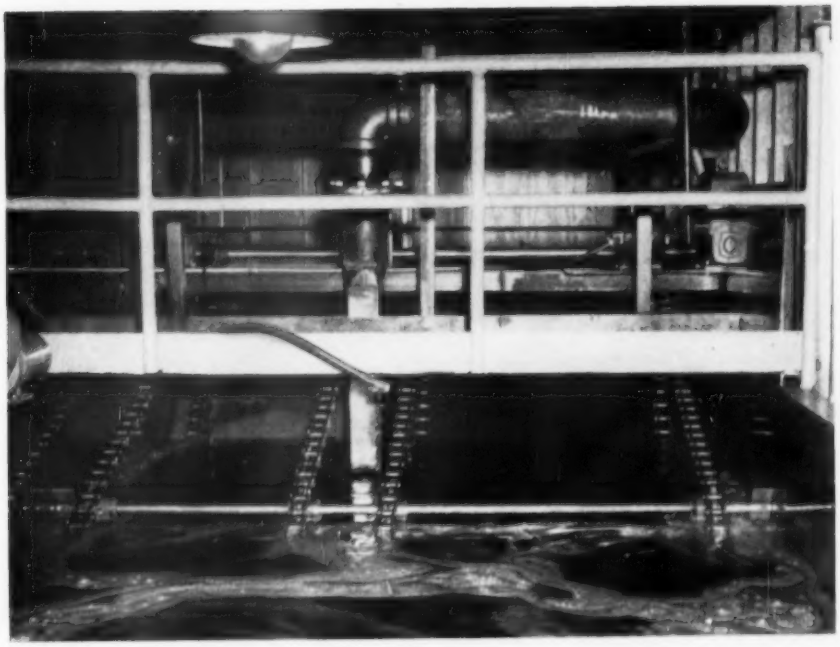
HOW PRESSURE FILTER WORKS

Depending upon the requirements, pressure filters may be connected directly to individual machines or they may be placed, as are ours, in a central location for handling all the of the coolant from large groups of machines. As dirty oil enters the filter under pressure, it is filtered through a metal screen, thinly precoated with an inexpensive filter-aid powder. In passing through the screens, all particles of insoluble matter larger than 0.000010 in. are removed. Sulfur and chlorine additives remain in the oil, unchanged and unharmed. After passing through the screen, the clean oil flows down a center tube into the outlet manifold, from whence it is recirculated to the machines. Our system contains 10,000 gal of oil.

Filter plates are all metal and we have had no problem with breakage or clogging. Easily cleaned, the plates are constructed of heavy mesh back-up wire and free-draining inserts. Screens are monel-wire cloth. Automatic scrapers remove spent filter cake.



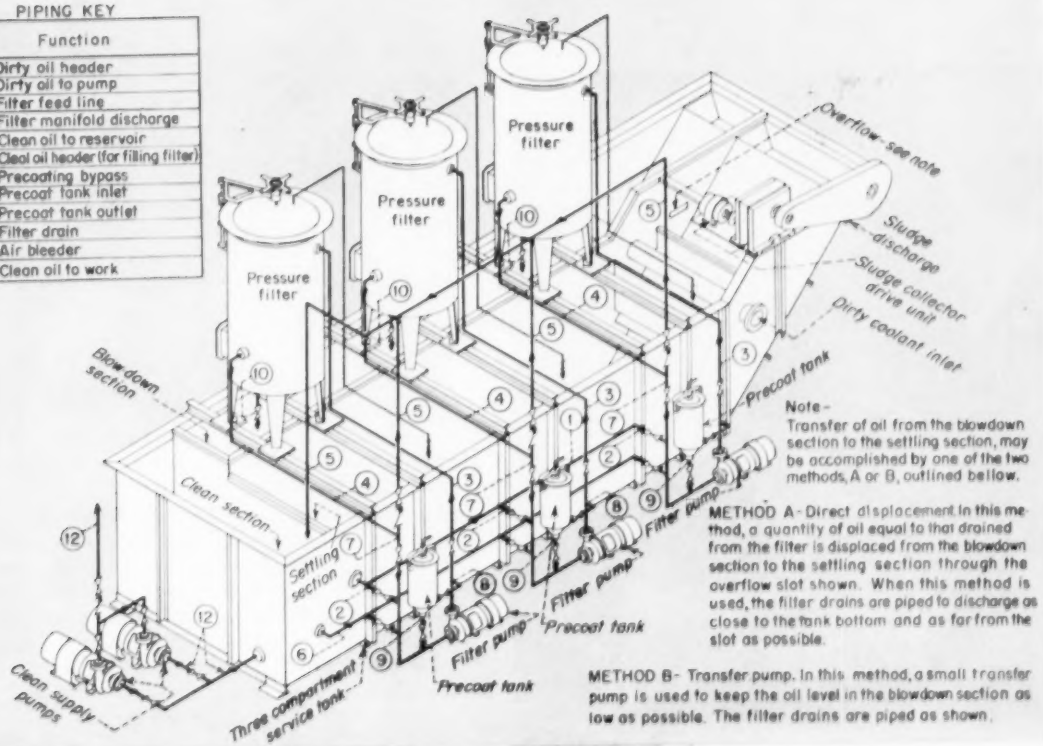
FILTER UNITS are placed alongside the combination settling and clean oil tank (see sketch) rather than on top. Motor just below unit provides pressure for pre-coating screens with filter-aid powder. Motors at right (one is standby for emergency supply) provide coolant through the filter at 20 psi. Clean coolant is stored in a reservoir until pumped to machines. However, entire 10,000 gal is circulated through the cycle every 45 min



SETTLING TANK receives dirty oil from sump and continuous scrapers on chain belt carry sludge from the bottom into a hopper at the end. Thus, heavier particles don't enter filter and lower efficiency

PIPING KEY

Symbol number	Function
1	Dirty oil header
2	Dirty oil to pump
3	Filter feed line
4	Filter manifold discharge
5	Clean oil to reservoir
6	Cleal oil header (for filling filter)
7	Precoating bypass
8	Precoat tank inlet
9	Precoat tank outlet
10	Filter drain
11	Air bleeder
12	Clean oil to work



Note -
Transfer of oil from the blowdown section to the settling section, may be accomplished by one of the two methods, A or B, outlined bellow.

METHOD A - Direct displacement. In this method, a quantity of oil equal to that drained from the filter is displaced from the blowdown section to the settling section through the overflow slot shown. When this method is used, the filter drains are piped to discharge as close to the tank bottom and as far from the slot as possible.

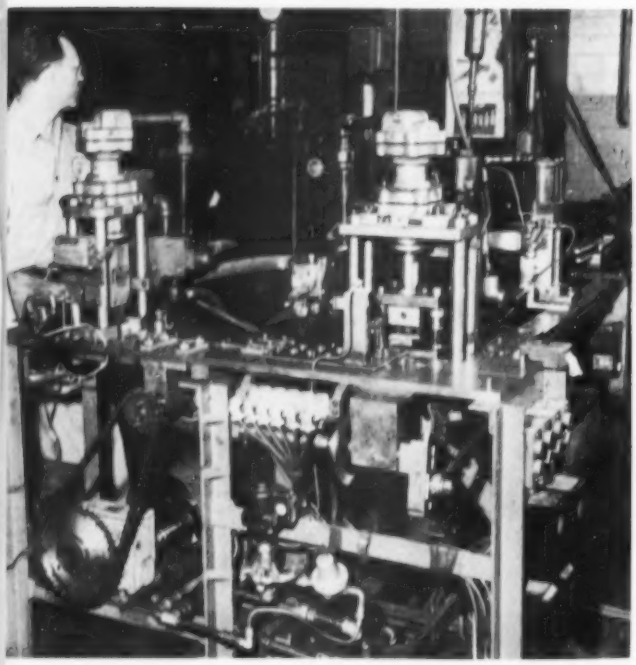
METHOD B - Transfer pump. In this method, a small transfer pump is used to keep the oil level in the blowdown section as low as possible. The filter drains are piped as shown.

TYPICAL FILTRATION SYSTEM shows pressure filters above tank rather than alongside, but operation is the same. Dirty coolant enters the settling section, then is pumped through pressure filter. From pressure filter clean coolant passes through manifold to clean oil section of tank. Sludge and filter cake are placed in blow-down to reclaim retained oil

FORMING "HAIRPINS" is fast and efficient in this setup for making U-shaped conductor bars for aircraft generators and starters. Multiple-slide machines form lighter bars, but this machine replaces hand bending of heavy conductor bars on a forming bench. Wire of 1/16 by 3/16-in. cross-section is fed from a reel to setup for a production rate of approximately 4000 per hour. About 50 hairpins are required in each generator or starter

"Home-made" machines solve

Short-lived product design and uncertain production runs are typical of the fast-changing aircraft industry. Special machines are needed for efficient production, but they must be flexible—and write-off time must be reasonable. Here are examples of special setups designed and built in a plant where frequent changes are easily handled



AFTER CUTOFF, conductor-bar sections travel at a 90° angle to feed travel to a forming station. Sectioned blades on a chain under the table project vertically through a slot for engagement at the center of the cutoff length. Each blade carries a wire through a series of four forming rolls for gradual bending into a tightly closed U-shape. Next station flattens the formed end (where a slight bulge is created by bending), after which the bar is automatically ejected by a power-driven wire brush

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JACK & HEINTZ, INC, CLEVELAND, OHIO

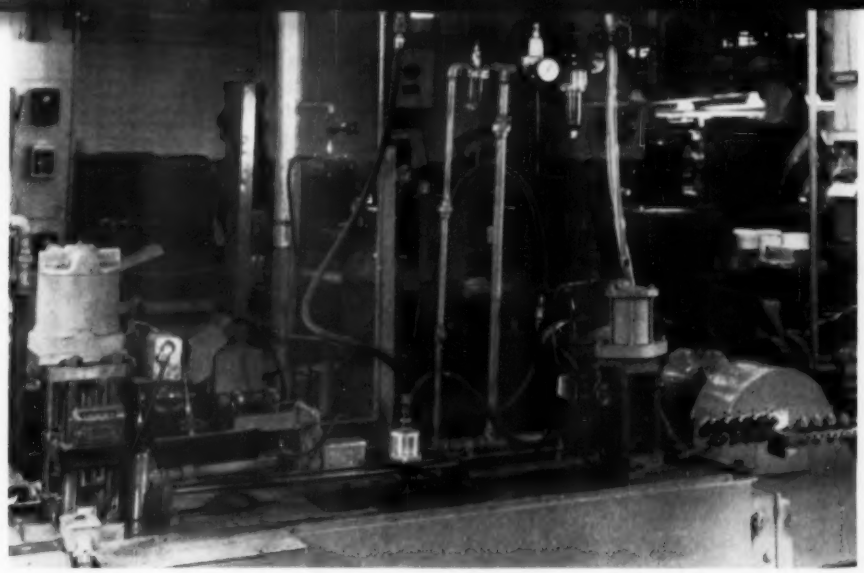
Flexibility is one of the most important considerations taken into account at Jack & Heintz, Inc, in laying out processing techniques for building motors, generators, starters, and other parts for the aircraft industry. Modifications in airframe and engine design make frequent changes necessary in product design here. Moreover, production runs are frequently interrupted to handle these changes.

As a result, special-purpose machines for efficient production must be designed to handle many similar parts having somewhat different features. For example, conductor bars for generators and motors are made in a wide range of different sizes and varying quantities. Machines built at Jack & Heintz can handle these size ranges and are designed for easy setup so changing over from one to another is not costly.

The same is true in welding, drilling and other machining operations. In all cases, machines can be written off in a reasonably short time. Appropriations for machines needed for a specific job are handled on a cost-reduction basis.

In addition to the simplicity and flexibility gained, other advantages include delivery on time because construction is controlled by the same management. Of course, servicing and maintenance are simpler too, because company personnel are familiar with them.

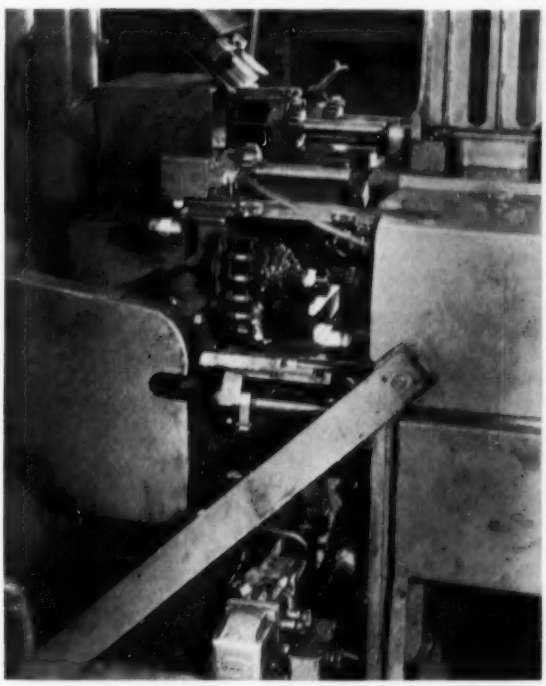
Standard, commercially available components are used wherever possible in this equipment to simplify



FIRST LEG of the trip through a hairpin-forming machine includes feed rolls and an air-cylinder-operated broach that skins varnish insulation from the edge of the wire. Sprocket and chain feed mechanism has adjustable linkage to vary the stroke for different bar sizes. A special air cylinder is controlled by a limit switch and rides with the mechanism to grip the wire for positive feed to the cut-off station. Here a small punch and die, operated by a double-acting hydraulic cylinder, form-cuts the wire. No positive stop is needed because of feed accuracy

variable production problems

MANUAL OPERATION IS ELIMINATED by this automatic setup for removing varnish insulation from formed hairpin-conductor bars. Hairpins are loaded into a magazine where a rack and pinion, driven by an air cylinder, actuates a blade that automatically feeds work from the bottom of the magazine to workholders on an indexing chain. Six holders are carried on the chain to pass three stations—burning, cooling, and wire brushing—at a production rate of approximately 4000 pieces per hour



FIRST STATION at the automatic varnish-removing setup is at the top and applies a natural gas and oxygen flame to burn varnish from the open end of U-shaped conductor bars. Second station sprays water to cool the parts and prevent oxidation. A wire brush at the third station cleans flat surfaces of the open ends. During this operation, parts are turned 90° to permit wire brushing the edges as well. About 12 different conductor bars can be handled in this setup by changing workholders, adjusting the magazine and the feed stroke. Speeds are adjustable, too, for faster operation on lighter wire with shorter burning and cleaning cycles

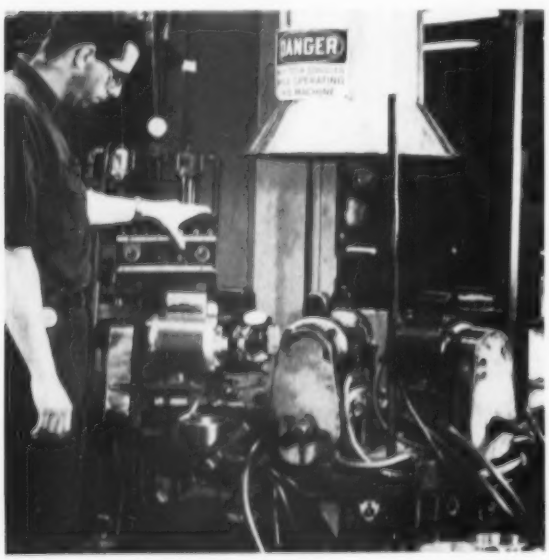
design and construction as well as to hold costs down. But wherever necessary, special parts are built into the machine to meet processing requirements. In machines for producing a variety of mounting holes in generator and motor housings, drilling and tap-pin heads are commercial items. On the other hand, air cylinders in a wire-forming setup were built specially for the job.

PLEASE TURN PAGE ▶

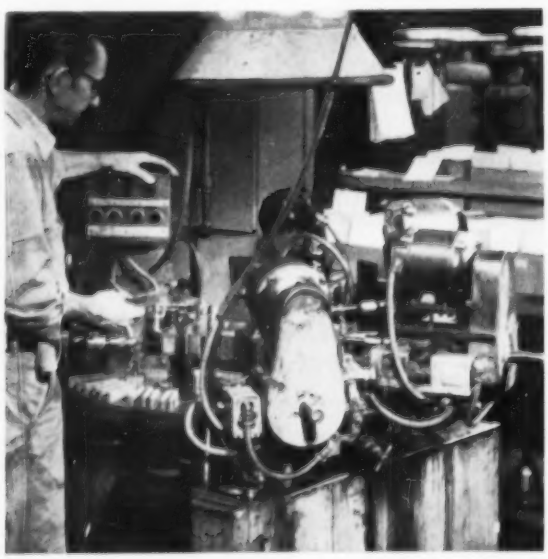
"Home-made" machines solve variable production problems . . . continued

TWELVE DIFFERENT STATORS ARE HANDLED in this automatic Heliarc welding setup where laminations are stacked and joined. Some generator stators are 11¼ in. long, require a stack of 450 laminations 0.025 in. thick; others are only 1½ in. long and take 60 laminations. An adjustable mechanical clamp positions arbors of different length on which laminations are loaded with grooves aligned with welding heads. Standard hand torches are mounted on adjustable fixtures that permit the welding of stators with varying numbers of grooves or of different diameters. Work arbors are water cooled and move downward past the welding heads at an adjustable speed to reach a positive stop at the end of the groove length. Hydraulic cylinder that actuates this travel has a fast return

ANY NUMBER OF HOLES in any position can be produced in different kinds of generator housings with this setup. Sub-land tools in eight Hy-Pneu-Mat heads drill and countersink mounting holes for mainpole and interpole assembly around periphery and along axis of housings. Work is positioned over a pilot dia and located from an axial hole in one end by a pin in the fixture base. A brushing cage, or drill fixture, with bushings to suit a particular job, goes over the work which is then mechanically clamped. Automatic indexing permits machining closely spaced holes on any axial line by carrying the work to necessary heads



ANOTHER SPECIAL DRILLING SETUP has six heads, handles short motor and starter housings. Here, too, bushing cages are changed for different housings that require various hole patterns for mainpole and interpole assembly. Except for manual loading and unloading, cycling is automatic



DRILLING AND TAPPING setup handles a variety of interpoles, produces holes that match those in housings in which they are to be assembled. In this 6-station machine, the first three stations each drill one hole, the following three tap them. Although loading and unloading is manual, positioning is automatic with a cam-controlled, rack-and-pinion-actuated clamp. The indexing work fixture is driven by an air-cylinder-operated rack and pinion and compressed air forces coolant to tools and work

Here's how . . .

For better management meetings

The best way to solve a chronic headache is a management meeting. But it must be planned and run well. Here are tips

GEORGE S ODIORNE, AMERICAN MANAGEMENT ASSOCIATION, NYC

There's no better way of solving chronic problems which have hung over your shop than to get all of your management staff together for a management meeting. Sharing of experiences, getting participation, and clarifying everybody's thinking can end up in action which will sew up the answers, provided such meetings are carefully planned and well run.

Maybe your problem is a cost-reduction program which has somehow run out of gas; a quality-control problem in which customer rejects don't seem to improve; or it may be that your sales and manufacturing departments are not working as a unit—with resultant broken promises and overtime in the plant. If so, a carefully planned and well-managed meeting may be the answer. There's one thing to remember about a management meeting, however; it requires good management to run a good meeting just as it does to run an engineering department, manufacturing shop, or sales office. Furthermore, since the men who attend management meetings are generally successful managers themselves, they expect that the meeting itself will show evidence of good management.

Experience with numerous management meetings shows that there are four basic areas where attention must be focused, if the meeting is to do the job for which it is intended:

1. Subject matter must be appropriate. The best place to begin with choosing a subject is to find your most pressing single problem. Are costs rising too rapidly? Is output falling off? Are grievances increasing? Is quality sliding off? Are there too many accidents in the plant? Are you having trouble obtaining and keeping good employees? Any of these might be a beginning of a management meeting. Define the problem fully, list all aspects of it, and you have the beginning of an agenda for your management to chew on.

2. Meeting structure is important. If you want to build support behind the program you hope to develop, it may be necessary to have several forms of meeting structure. You may want the president or general manager to explain the problem and its many facets in classroom structure. After this you may wish to break up into smaller groups for conferences and discussion groups. If prepared material is used, you may want to use the case-study method or have several members of the management team act out certain of the situations in role playing. Each form is especially adaptable to a particular goal. In addition to maintaining interest, you'll find that changing the meeting structure from time to time during the meeting—especially on an all-day meeting—will provide you with a pinpointed approach to solution. While it's interesting to the speaker to lecture all day, it's tougher on the poor guy who has to sit on a chair and squirm. Even the softest chair gets hard after six hours, especially for a supervisor who isn't used to being chair borne.

3. Speakers and leaders. It's important to get people as speakers and leaders who have something to say and know how to say it. They may be company officials; or they may come from outside the firm: trade associations, suppliers, customers, university faculties, consultants, or even competitors. Before inviting anyone to talk to your management staff, however, better check with someone who has heard him speak before. Tactfully suggest that he might use visual aids; and help him prepare them, if necessary, to break the routine of straight lecture.

4. Physical facilities. Surroundings are important to the success of the meeting. If you have a comfortable conference room or cafeteria, use it; but plan carefully on the number attending, and how to break up the group, if you plan discussion groups. Many companies now hold meetings off company premises where the phones aren't ringing, and the noise of the plant can't interrupt. All-day meetings especially are better conducted off the plant in a local hotel, country club, or similar location. More and more companies plan annual, semi-annual, or quarterly meetings of their staff some distance from the daily grind at such places as resort hotels or country clubs. If it's an especially important subject, such as a decentralization plan, a new cost reduction or management development program, or revised cost-control system, it will be especially underlined by taking the staff completely out of the work situation.

If the subject is important enough to take the management staff off the job for a day, it's worth investing a few dollars more in good facilities, new blackboards, notebooks and pencils, and renting projection equipment to show materials visually.

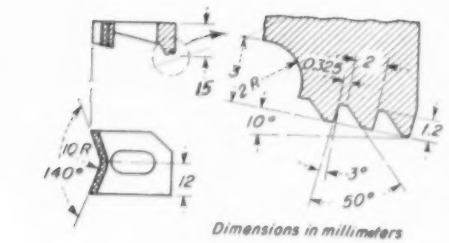
5. Make one person responsible. If your company has a training director, he's a logical one to plan and organize the meeting; but the subjects should be selected by line persons, who know what pressing problems are. In the absence of a training director, as in a small company, the personnel manager, or some key staff person may be given the job. In any event, it's wise for the highest interested person in the company or division to actively take part in making the decisions and to kick the meeting off.

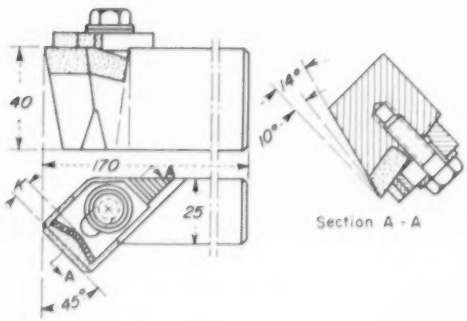
6. Check the reaction of the people attending. After the meeting, within a few days while it is still fresh in their minds at the latest, have everyone attending record his reactions. Ask about the good things as well as the things that could have been improved. This will become a sound guide to conduct of future meetings.

Three Russian Ideas:

- **Clamp-on chip breaker with unusual shape—it reverses the chip so it can't ruin the finish on surfaces already cut**
- **Case-hardening test—it uses magnetic pull to gage thickness of the case**
- **Local magnetic-powder inspection—it requires pencil-size magnet and powder; that's all**

Abridged and translated from Russian publications





TURNING-TOOL CHIP BREAKER has 140° V-notch in front, which breaks up chip because of friction, and forces it almost back on itself so it flows toward the unmachined area of the work

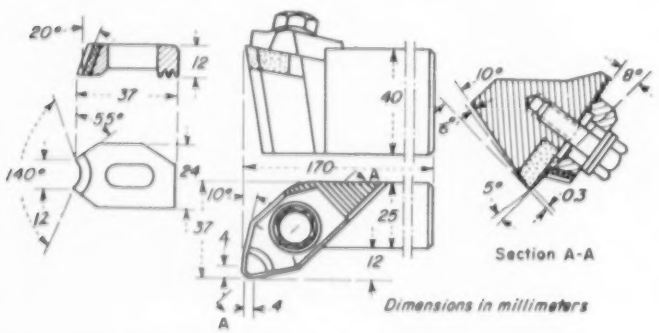
New Chip Breaker, by B E Brushtein & F M Polonchok, published in *Vestnik Mashinostryeniya* (Mechanical Engineering Journal), 1955, No. 1, p 62-63

Most chip breakers force metal chips to break up as they come straight away from the work, in a direction opposite to the cutting force. This breaker forces the chip around in a different direction, which prevents it from damaging surfaces already finished.

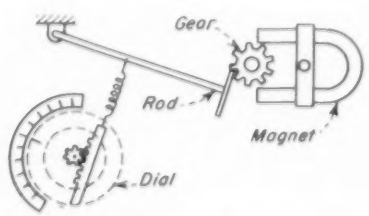
Extensive tests have shown that the clamp-on chip breaker works as designed if the speed is 50-600 mm/min, depth of cut is 1-10 mm, and feed is 0.08-2 mm/rev. For turning or boring operations, the distance K, between front edge of tool and front edge of chip breaker, is important.

Depth of cut (mm)	Feed mm/rev	K, mm (turning)	K, mm (boring)
1-2	0.2-0.3	6-9	4-5
3-5	0.3-0.5	9-13	5-6
5-7	0.5 & over	13-15	6-8

Over 3000 breakers of this type have been tested during 1½ years of shop operations, and they are



BORING-TOOL CHIP BREAKER has similar contour, but V is replaced with radius. Fore edges on both types are hard-faced with a 2-3 mm layer of hard alloy (cross-hatched)



"TEAR-AWAY" TEST is made with sample gear in field of U-shaped magnet. Cross bar on magnet allows shunting off part of the magnetic field to allow adjustments. Rod that touches gear is magnetic, and finally pulls away as dial is rotated. Reading at instant of "tearaway" indicates thickness of case

now in use for more than 300 turning and boring operations.

Case-Hardening Test, by I P Vyazova, published in *Zavodskaya Laboratoriya*, 1955, No. 1, p 110-112

Depth of case hardening on small gears, with 30-mm pitch dia and 14 teeth, was difficult to test by conventional methods. But it was known that the magnetic permeability of a case-hardened layer differs from that of the gear core. Therefore, a number of "tear-away" instruments were made.

A field of low magnetic permeability provides maximum difference between readings on successive teeth of the same gear, which allows most accurate comparison between case-hardening depths.

The equipment must be calibrated to a standard, found by experience, from which it will indicate variations in depth of the case.

Local Magnetic-Powder Inspection, by M V Miroshin, published by *Zavosskaya Laboratoriya*, 1955, No. 10 (Oct), p 1197-1198

Surface defects can be found on parts of irregular shape with magnetic powder and a "pencil" depositing magnetic stick. The rod should be about 100-150 mm long and 10-15 mm in dia, with a coned end. It is dipped in powder, shaken to remove excess powder, then traced over the part by scanning the surface in two directions.

The magnetic rod itself provides the magnetic pole power, which makes the powder deposit when cracks, etc, interrupt the moving magnetic field provided by the rod. Such parts as rails, tubes, and tractor pistons have been inspected this way.

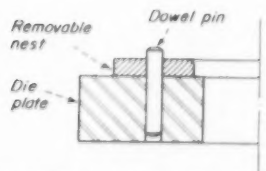
Depth of the case hardened layer on the teeth of gears

Depth of case-hardened layer measured by the described instrument. mm.	Depth of case-hardened layer according to the data of the Metallurgical Laboratory. mm.
One tooth 0.1 - 0.2 The others 0.4 - 0.5	One tooth 0.1 - 0.2 The others 0.4 - 0.5
0.5 - 0.6	0.5 - 0.6
0.5 - 0.6	0.5 - 0.6
0.5 - 0.6 - 0.65	0.3*
0.4	0.4
0.7 - 0.65	0.6
0.4	0.7
0 8	0.7
0.5 - 0.6	0.4
0.4 - 0.5 - 0.6	0.5 - 0.6
0.5 - 0.6	0.4 - 0.5
0.6 - 0.7 - 0.8	0.7 - 0.8
1.0 - 1.1	0.7 - 1.1
0.3 - 0.4	0.4
0.5 - 0.6	0.5 - 0.6
0.45 - 0.5 - 0.65	0.7
0.6 - 0.7	0.5 - 0.6 - 0.7
0.5 - 0.6 - 0.7	0.4 - 0.5
0.6	0.4*
0.6 - 0.7	0.4*
0.4 - 0.6	0.50.5 - 0.7
0.45-0.6	0.4 - 0.5
0.7 - 0.8	0.7 - 0.8
0.5 - 0.6	0.5 - 0.6
0.5 - 0.6 - 0.7	0.6 - 0.7
0.55-0.7	0.5 - 0.6 - 0.7
0.58-0.72 and one tooth 0.8	0.5 - 0.6 - 0.7
0.55-0.7	0.3 - 0.45*
0.4 - 0.5	0.7 - 0.8*
0.6 - 0.3 - 0.6	0.6 - 0.3 - 0.6

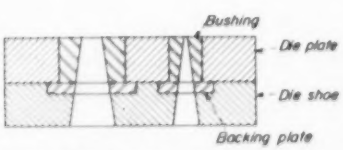
CASE-HARDENED LAYERS ON SAMPLE GEARS were tested two ways; with magnetic system, and by metallurgical means. Correlation between readings shows accuracy of magnetic system. Readings marked * were for cases where magnetic saturation of gear was either unusually high or low

Diemakers' Kinks

FEDERICO STRASSER

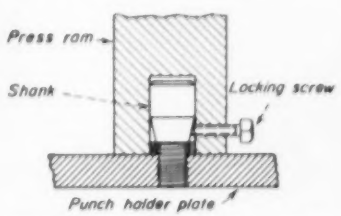


FINE CHIPS produced by shaving dies are a nuisance, because they give trouble in proper location of the workpiece in the nest. To save trouble in cleaning the die, avoid screwing down the nest. Instead, use over-size dowels.



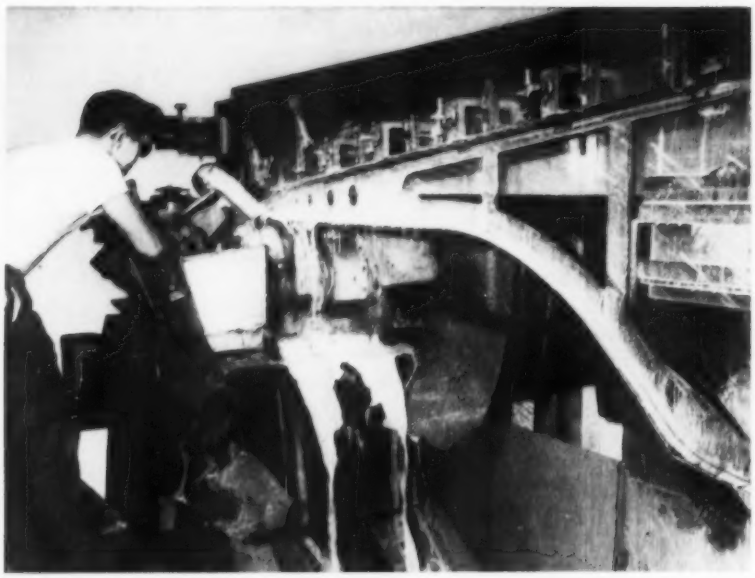
COMPOSITE dies are cheapest for punching large panels. Insert die bushings in a machine-steel plate. Back them up with hardened pressure plates sunk into the die shoe.

IF A SQUARE bend must have a sharp corner, make the piece in two operations. In the first operation, produce the conventional rounded corner; in the second, iron the metal to a sharp corner.



SHANKS in punch-holder plates must be firmly fastened. In this case, the shank has a locknut. The shank is retained in the ram by means of a screw bearing against the taper on the shank.

WOODEN MOCKUP of Pend-A-Grinder was built in three days in carpentry shop to check out motions and clearances of complete machine designed at Rohr. After this, final design was determined, and actual machine was built

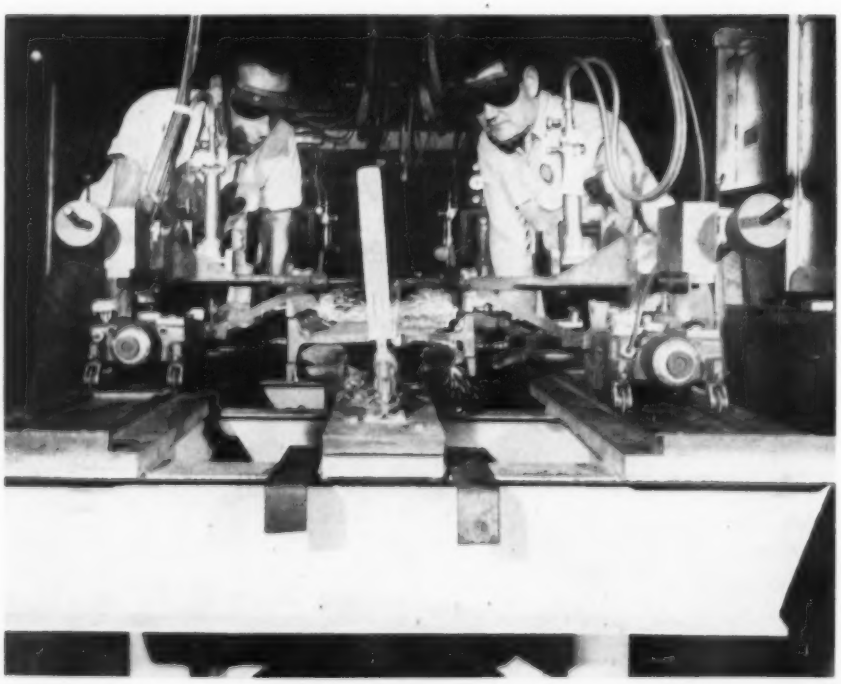


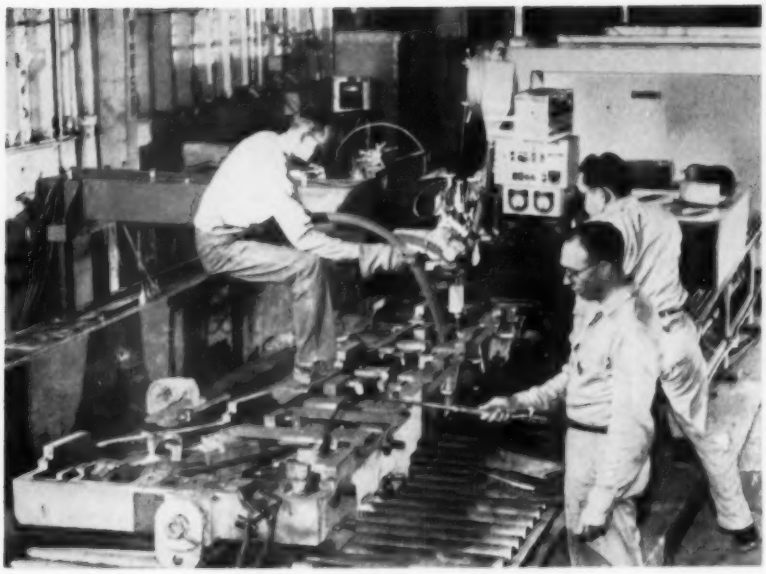
WORKING PEND-A-GRINDER finishes three surfaces of the curved flap tracks; will handle seven different sizes and radii. One 16-in. wheel does bottom surface, and two 10-in. wheels angled at 45° grind the edges. Machine has special high-powered motors and all bearings mounted in boxes so they will not be disturbed when wheels are changed. Unit grinds 80% faster than old methods and more accurately

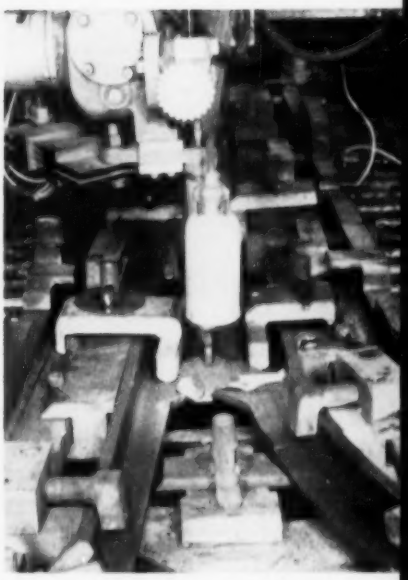
When special machines are required . . .

ROHR MAKES ITS OWN

DOUBLE OXYGRAPH SETUP with four Airco torches cuts apart steel I-beam that is basic material for curved tracks. Center web section is scrapped after it falls away. Torches follow templet magnetically. Afterward, tracks are heated to 1600 F and formed to required curves in HPM press

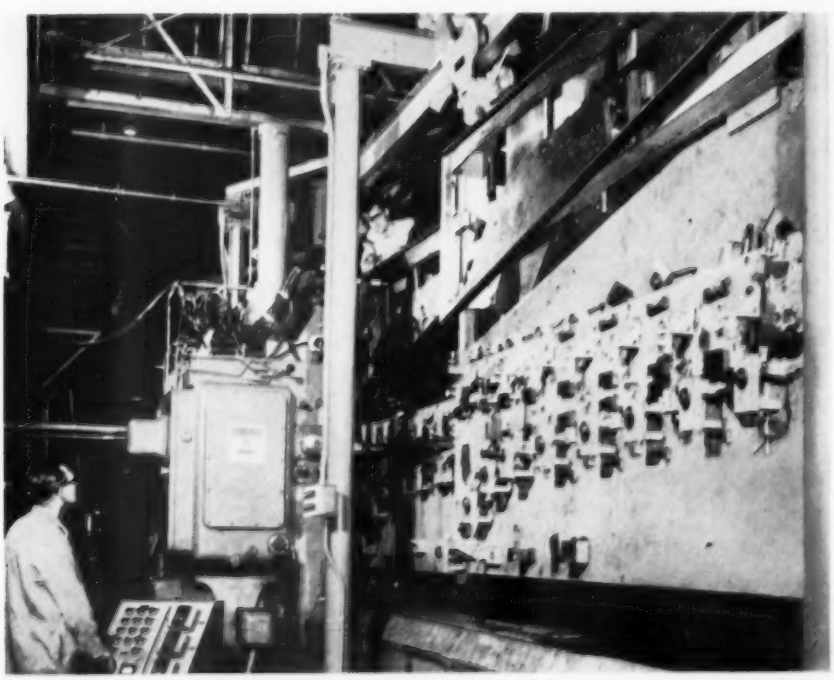




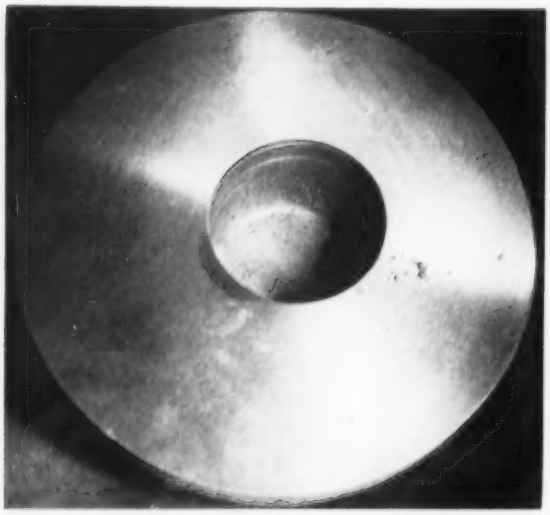


POWERED FIXTURE runs under fixed submerged-arc welding head to join curved and straight track sections. Roller sections on both sides support fixture, but drive is through middle, between rollers. Welding speed is 22 ipm. Other side is welded in reverse fixture

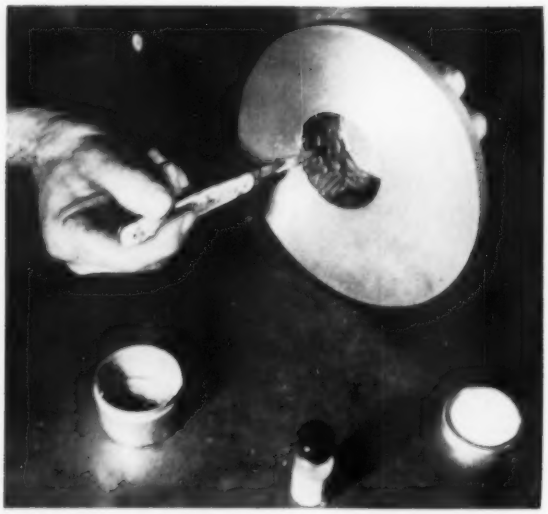
These four invented and adapted machines do a grinding, a milling, and two welding operations on tracks that guide flaps on large airplanes . . . Some of the equipment was originally intended for other jobs, some was bought especially for these setups outside the plant, and some was fabricated in Rohr Aircraft Corp's own Chula Vista plant



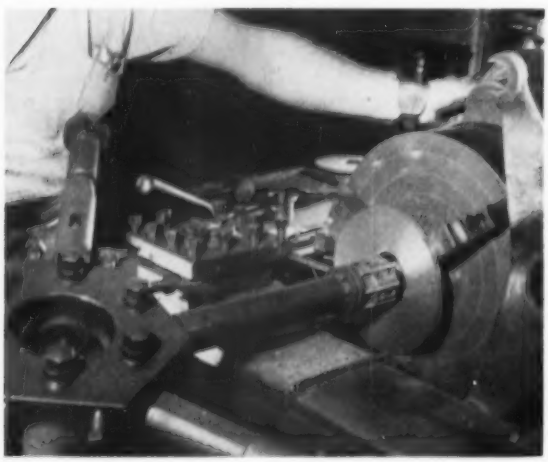
◀ **7000-LB ANGLE PLATE** on Model 66 Sundstrand miller is a huge vacuum chuck, set up to hold flap tracks in vertical plane. Machine has been fitted with redesigned tracers and overhead transfer system with which fixture plates can be interchanged—pushbutton operated. Maximum chuck holding force is 85,500 lb



Surface defects in casting . . .
usually show up after machining. Replacement from foundry could be obtained, but then average $5 to $6 already spent on machining would be wasted. If defect is non-structural, casting is set aside for salvage. Welding, soldering, and metal putty were considered as repair method



Metal putty is applied . . .
to defect with knife or spatula with enough force to fill cavities. An epoxy compound made by Smooth-On Mfg Co, Metalset A2, was chosen as being cheaper than welding, stronger than solder. Putty is mixed with one of several curing agents available, 01, to cure at room temperature to 14,400 psi compressive strength



Patched surface is machined . . .
after curing by returning casting to production line. No change in machine settings is required to face or bore off excess putty. Procedure is to collect housings that show casting defects and repair in a batch

Which casting has the patch?
It is easy to see that it is the one at right because of difference in reflectivity. No other difference in surface is discernible. A bronze bushing is placed in the well when pump is assembled

Castings salvaged with epoxy compound

For cosmetic reasons, non-structural defects in housings for rotary-vane pumps must be filled. Here is a simple technique for such repairs that permits an air cure

American Machinist
SPECIAL REPORT NUMBER 425

Models are tools . . .
. . . not toys

Three-dimensional models of machines help lay out and rearrange production lines, demonstrate design principles, and are becoming increasingly popular as visual aids for other metalworking problems. Some are stationary, others movable — and many are actually working models of the equipment they represent. Here's how models are made and used in a variety of applications

GEORGE H De GROAT
associate editor

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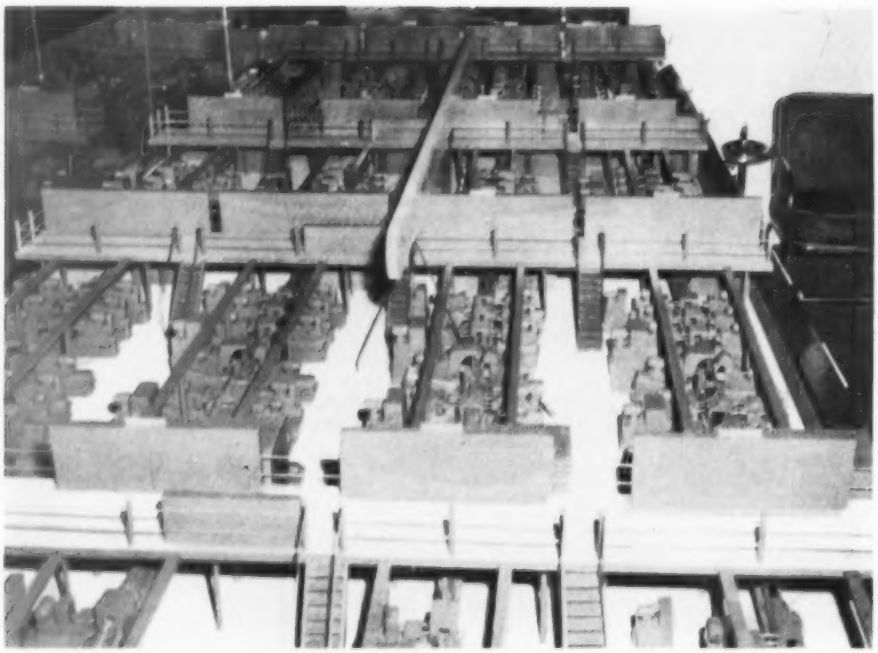


Four complete 400-ft cylinder-head lines . . .
are represented in soft-pine models made by a pattern maker for W. F. & John Barnes. Layout is a scale replica of lines at Plymouth's engine plant in Detroit, shows electrical panels on balconies

Why the third dimension?

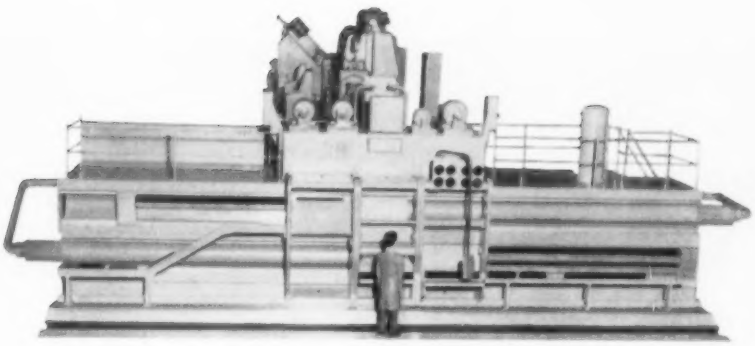
Any good engineer is supposed to be able to read a blueprint. But many otherwise-competent engineers and shopmen have difficulty visualizing in three dimensions, and even those who can must take much time to study out a print. The layman—be he visitor or executive—frequently can't read a blueprint at all. Hence, those little machines you see on the desks of master mechanics and plant engineers are not toys—or souvenirs from machine-tool builders—they are useful tools for planning and construction. So are the models on layout tables in engineering departments, in plant lobbies, or in exhibitors' booths at industrial shows. So are the plant models in planning and methods departments. Besides machines and their components; buildings, conveyors, furnaces, pipelines, processing, systems, materials-handling equipment, and even people are represented 3-dimensionally—to accurate scale. All are used effectively for a wide variety of purposes.

A model with each machine

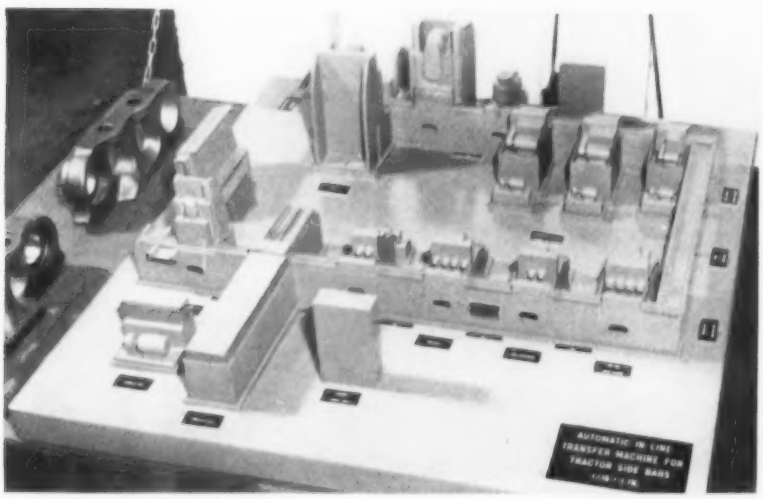
Those most widely used are stationary miniature (⅛ or ¼ in. to the foot) replicas of machines, materials-handling equipment, and other devices of major importance in production lines. Set up in position according to proposed plans, models provide a layout that quickly points up all the variables involved: safety hazards; waste space; clearances for overhead cranes and conveyors; location of personnel and their access to each other, to tools, and other facilities; and numerous other considerations necessary to good planning. Moreover, the models are easier to handle than flat drawings or cardboard cut-outs, and the third dimension takes care of planning for "air clearance." In conjunction with 2D layouts—necessary for blueprints used by riggers, maintenance men and others—they insure a high degree of accuracy and efficiency in planning.

In one instance, a 3-dimensional layout showed that the proposed position of a swinging floor crane was such that it would hit another machine in carrying work to the machine it was to serve. Relocating it was a simple matter, after the condition was discovered by means of models which clearly indicated interference at the vertical height required. A large automobile plant, in planning a new machining line, built up a 3D line by requesting machine-tool builders to supply a ¼-in.-to-1-ft model with each machine bought. The request even stipulated that models be the same color as the machines.

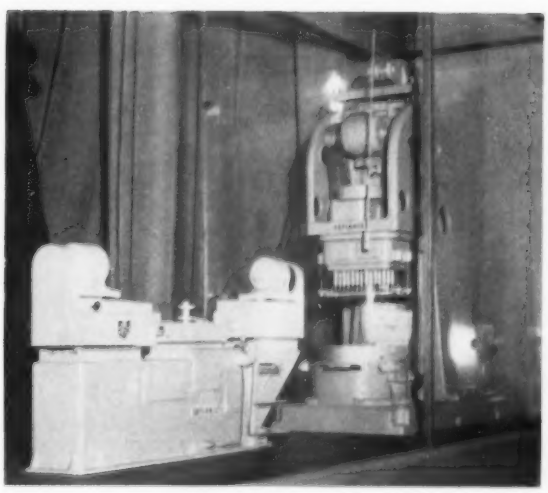
Although the auto builder received models of machine tools and production equipment, it must



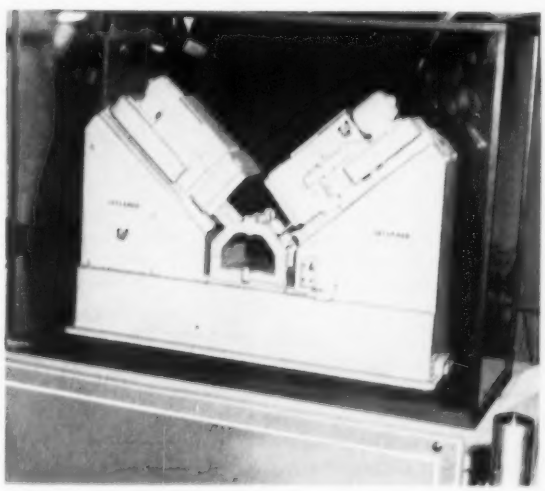
Stationary display model . . .
of American Broach & Machine Co duplex horizontal surface broach was at the NMTBA Show. Besides attracting attention, such models permit sales engineers to point out features of design and show general proportions



Automatic in-line transfer machine . . .
for machining tractor side bars is represented by this model at a scale of 1/16 in. to 1 in. Parts at left compared with the model provide an idea of actual size of the machine. Base facilitates display of the model, while tags identify various units and operations performed. Individual machines are simply non-detailed "masses" to show arrangement

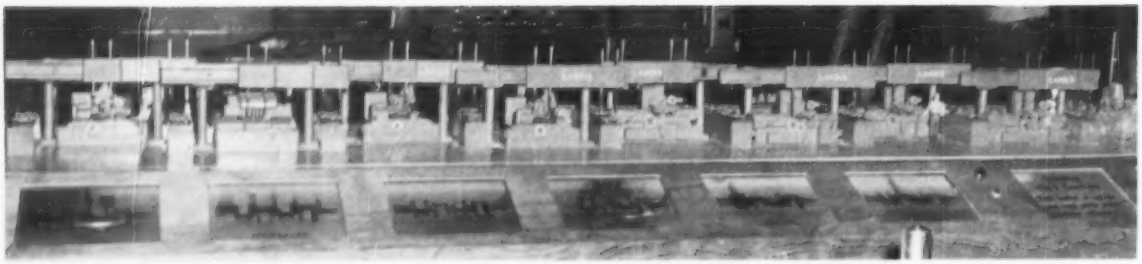


Two stationary display models . . .
are employed by The Ohio Machine Tool Co to illustrate special machines. At left is a replica of a 3-way boring, facing and drilling machine for manifold cam units—in the rear a 19-spindle drill with a hydraulic table for tube sheets. Both models were at the NMBTA Show

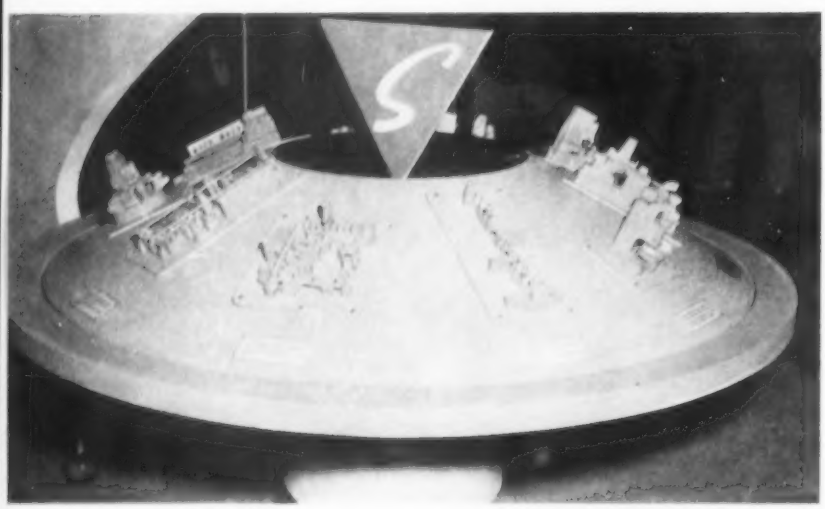


Glass case . . .
encloses and protects this model of a way drill for V-8 cylinder bore built by Ohio Machine Tool Co. The model shows construction, relative size and location of components. It is to larger scale than plant models so more details can be shown to prospective customer or operator

Models are tools . . . not toys

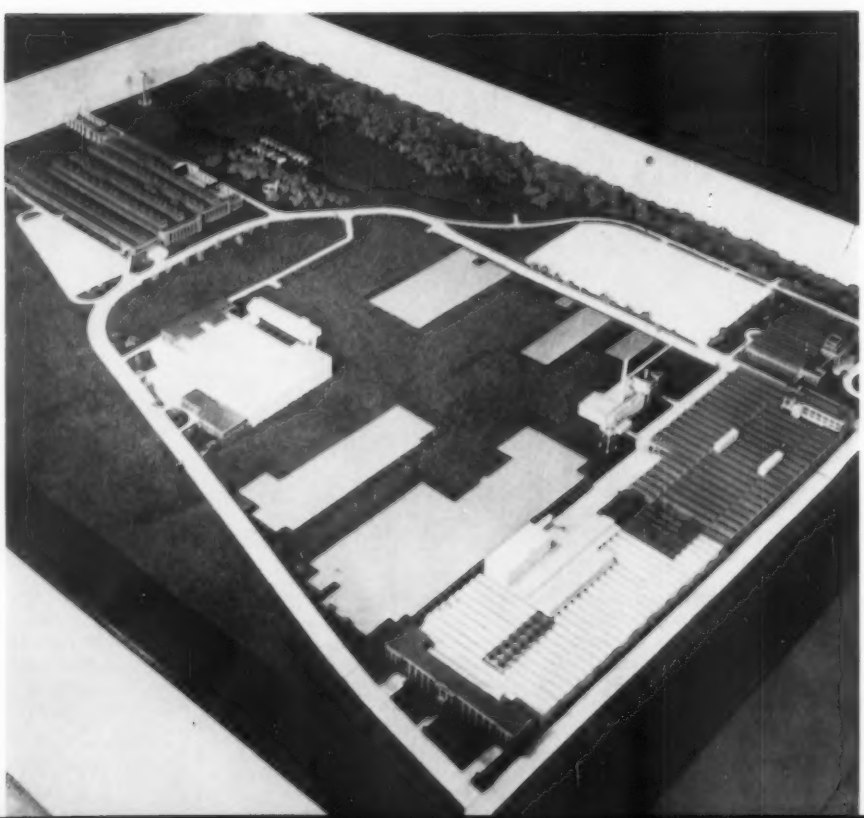


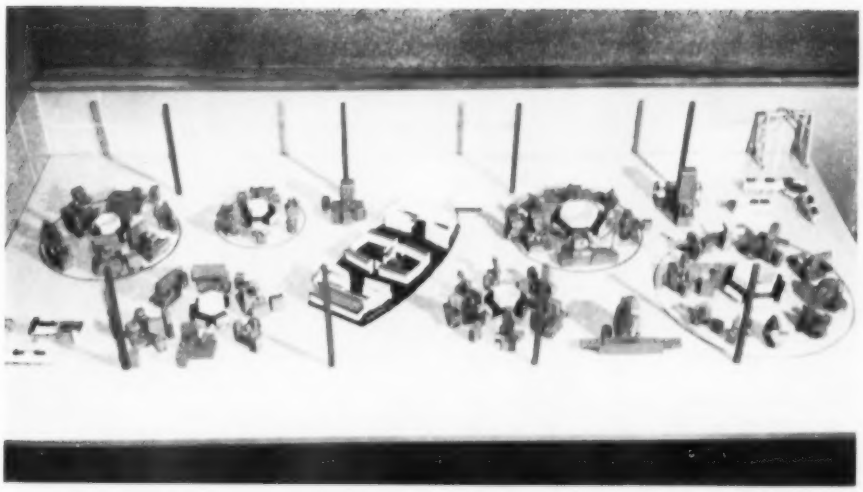
An elaborate scale model . . . of a line of Landis automatic crankshaft-grinding machines includes lighted foreground diagrams that illustrate sequence of operations, work flow and bypass arrangement. Model was useful for demonstrating layout of line before machines were actually built



Turntable with stationary display models . . . helps exhibit typical Synder Tool & Engineering Co special machines. Visible at left foreground is a special 18-station pallet-type square transfer unit for machining front covers for auto engines. At the right is a replica of a segmented transfer machine for rocker-arm shafts. Originals are large, so photos would be of little help

Planning plant sites . . . is simplified with scale models that show property lines, buildings, roads, and other facilities. This model, representing Cincinnati Milling Machine Co, helps evaluate requirements for immediate and long-range development, illustrates use of simulated grass and planting





About 180 hours were required . . . for one man to make this set of machine models. Layout helped Cincinnati Milling Machine Co plan display of machines at NMBTA Show. Models were of scrap pattern mahogany to a scale of ½ in. to 1 ft, using home-workshop tools. Six circles of dots made with colored "Zip-a-Tone" to outline groups of models were carried out full scale for groups of machines at the Show

Little people help . . . visualize actual conditions and size of machines in layout of machine lines. Most "operators" come from model-railroad sets—at a scale of ¼ in. to 1 ft.—are difficult to find in other scales. Layouts like this can be set up permanently for quick analysis of actual working conditions, work flow, and study of future needs

be pointed out that those elements usually account for only 20% of the equipment necessary for a complete layout. Placing machine tools alone is far less involved than the layout problem created by movement of work through the plant. Materials-handling models alone include conveyors, trucks, skids, pallets, the product itself in various stages of processing, raw-material storage, partially completed-parts storage, and parts-in-process storage, among other things. These and other equipment models are made of wood by pattern-makers in the auto plant. With the complete layout, plant engineers are able to plan layout of a whole line or plant and study work and material flow as well as the availability of space for removing or adding equipment with complete assurance that their layout is accurate. Photographs of original and proposed layouts provide a permanent record, and properly taken vertical photos can be scaled.

In another instance, a large aircraft, plant made a comprehensive study of four methods of plant layout—preparatory to construction of a 78,000-sq ft manufacturing building that included laboratories and office space. Rejected was the conventional 2-dimensional paper cutout method because of its temporary and unfinished appearance, high cost of construction by personnel whose time might be more usefully employed otherwise, and the difficulty of reproduction. Two-dimensional plastic templets designed primarily for rapid translation of a layout into prints were also rejected because they were not suitable for a permanent plant-layout control board, not adaptable for formal presentations, and actually cost more than a 3D layout would. A third method investigated and rejected for the same reasons employed two-dimensional layouts made of photographic-negative material.

The 3D method finally used included plastic mod-

Knockdown display model . . .
is made in three separate sections that go into one case for transport to customer plants. Special Machine Div of Cincinnati Milling Machine Co employs this model to show setup of a 2-way, 300-hp horizontal cylinder broach, (first model) and a one-way, 250-hp broach, (second) for automatically machining V-8 cylinder blocks. Photographs and backboard give details

Photographs with stationary models . . .
make excellent displays. This one illustrates equipment developed for a V-8 block line, clearly indicates work flow, sequence of operations, location of operators, and features of the line

els of all machines and equipment as well as a layout board of ¼-in. gridded transparent plastic plates in 24x36-in. sections. Mounted on the board were columns, walls, and other architectural details. Bases of 3D models were cemented to the plastic plate. For reproduction purposes, transparent sheets of gridded plastic 1/64 in. thick and two-dimensional templets of machines were included. The latter were printed as transparencies on photographic film and were made at the same time as the models.

When the layout was complete, the layout plate was turned upside down and supported by the building columns. Thin sheets of plastic were laid over the inverted layout and 2-dimensional templets were pasted on the plastic sheet over corresponding models. Ozalid prints were run from this sheet (inverted, of course, for orientation) to provide any desired number of working prints—in addition, a permanent plant layout control board was available by returning the 3D layout to its upright position. Cost of this setup, with the building model, was $5460 and included 2249 models of equipment and an equal number of 2D templets that could be used over again for reproducing different layouts. It may be of interest to note that the ratio of productive equipment to non-productive in this case was 1 to 5.

An elaborate setup that cost $40,000 saved the user at least four times that much within a very

short period. This was a set of models for a builder of oil refineries and included every pipe in a plant, all color-coded. Time normally required to trace extensive piping in subsequent installations was reduced to a minimum, and contractors were quickly able to determine the most-efficient sequence for installing pipe. This model was carried to the site and used for reference in much the same way as the plans and blueprints. This type of model is commonly used in power-plant planning because of the complexity of piping systems.

Builders use them

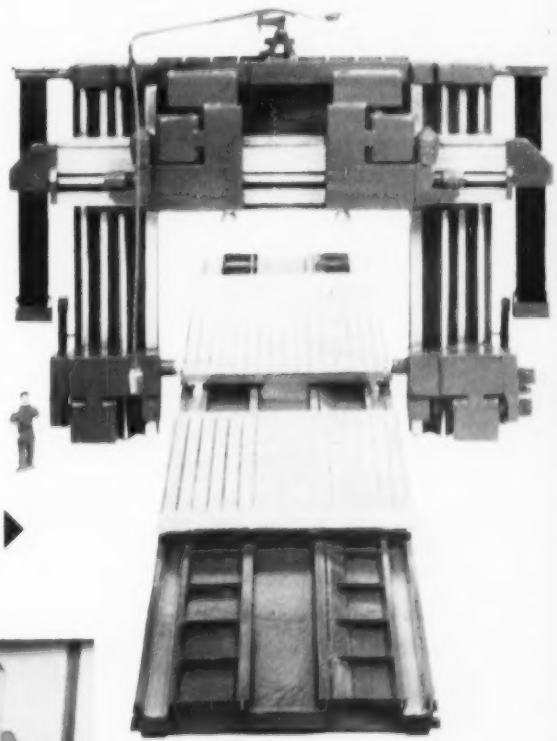
Machine-tool builders themselves use stationary models of their machines to present their ideas to customers. Whole lines of integrated equipment are thus displayed—or one or two machines can be shown. Cincinnati Milling Machine Co, for example, made good use of such models for planning the display at the National Machine Tool Builders Show. These were built by George Schmitz of the company's advertising department, to a scale of ½ in. to 1 ft (about twice as big as those commercially available) to show greater detail.

Of 44 machines shown at the Exposition, a like number of models were built and arranged on a proportional floor-plan. This permitted planning the best arrangement possible, helped location of power sources and other facilities. Maintenance and setup men actually used dividers on the models to determine lengths of wire needed, space available for crane travel, and to study the sequence of machine placement. This particular group of models was used later for rearranging a permanent display in the company's show room.

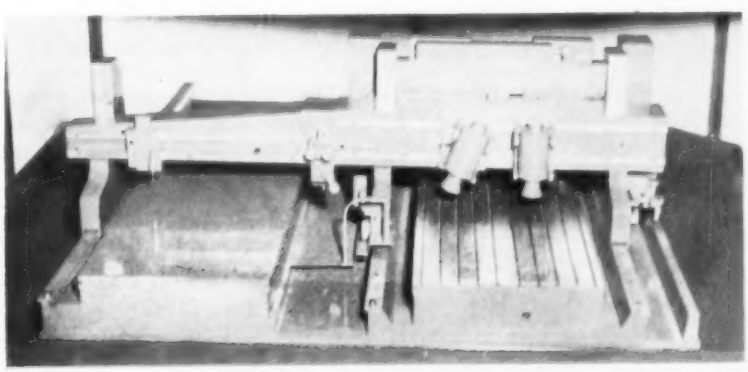
Movable models demonstrate design

Lithium Co, Newark, NJ, has simplified the problem of demonstrating features of recuperative furnaces by ingenious scale models. For the past three years, John Bendel of Belleville, NJ, design draftsman with the firm, has employed his spare time making accurate wood models that can be taken apart to show what goes on inside these furnaces—a matter of considerable importance to prospective customers. Being exact duplicates of various types of furnaces, the models include flues and other parts hidden by brickwork and are so constructed that walls, roof or any other component can be removed and replaced.

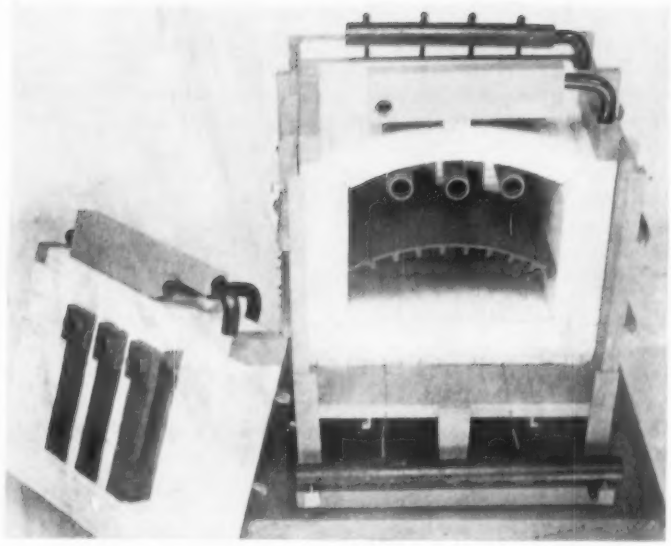
This eliminates long study of specifications and prints which at best only provide a 2-dimensional interpretation of features. Salesmen are equipped with carrying cases containing Bendel's models, which are light and sufficiently rugged to permit numerous demonstrations. According to the management, this means of demonstrating furnace de-



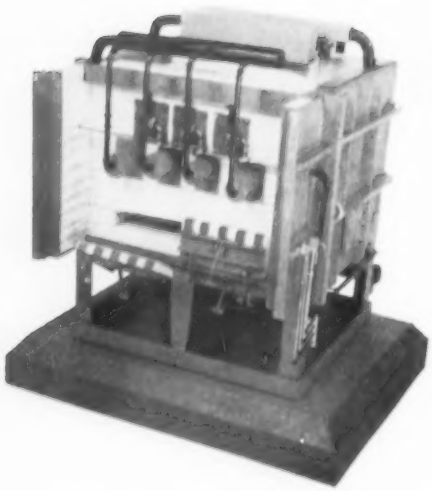
Bed and control panel . . . of this ¼-in.-to-the-foot model are movable by hand to show operations. It illustrates a large twin-table Ingersoll planer-type miller. The operator is scaled as a 6-footer to give relative proportion. Note that underfloor elements are not shown



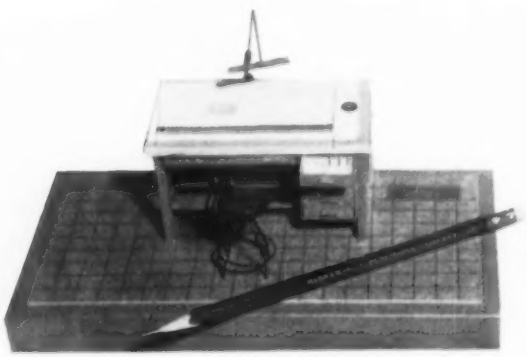
Movable model made of aluminum and wood . . . demonstrates action of heads and machine on ways. A gantry-type skin miller developed by Special Machine Div of Cincinnati Milling Machine Co is duplicated by this model made to be carried to customers' plants. At the Machine Tool Show, it was on a slide under a table. Note tilting head



Infinite patience . . .
and considerable ingenuity . . .
went into the building of this model of a Lithium Co recuperative-atmosphere furnace. Sections are removable to permit study of parts normally hidden by firebrick. Models like this are made on a spare-time basis by a design draftsman employed by the firm—are extremely valuable to sales engineers



Model of a drafting table . . .
is another example of model-makers' skill. Bits of wire, basswood and paper were used in its construction. Authentic detail includes triangles, drawers that open and close, a drawing on the board, (complete with dimensions) and a part for study. Draftsman's stool is adjustable, as are the lamp and table top

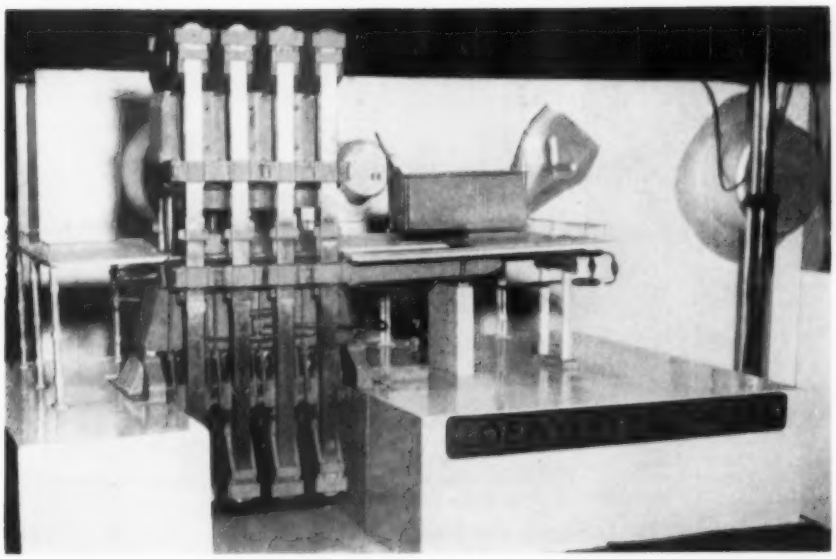


sign and construction has paid for the models many times over.

Such models are also used by Cincinnati Milling Machine Co for field-service training, and sales demonstrations. A movable model of the Hydro Tel hydraulic circuit, for example, is adjustable to include or exclude valves and other components, depending upon the type of Hydro Tel being demonstrated or studied. Specialists can take the model to a customer's plant and teach employees how to maintain and service a particular Hydro Tel. This is typical of the low-relief and part models coming into increasing use. They are lighter than cutaways of actual parts, more graphic than pictures. And the viewer can operate them.

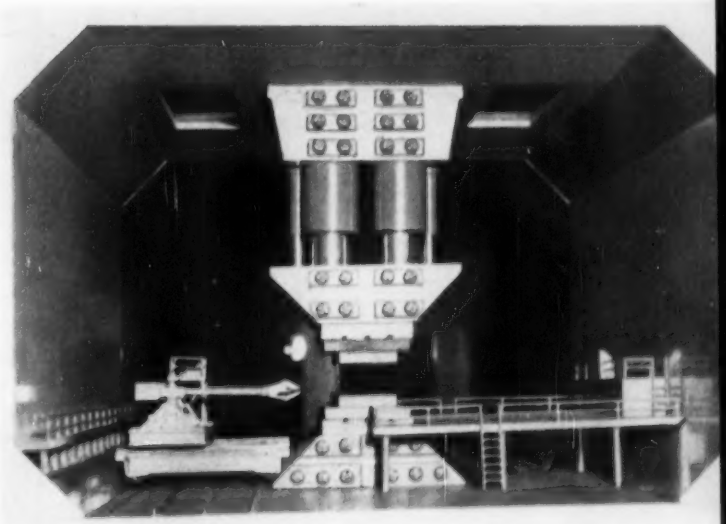
Another movable model is a full-scale, false-front, or skeleton, replica of the front bed of a Cincinnati grinder. Actual control knobs, handwheels and other parts are included to facilitate demonstrations in operating the machine. Also, a new dial-type milling machine has been duplicated in wood to permit study and demonstration of its construction. All major components can be assembled and disassembled in minutes, to show customers the relationship of saddle, over-arm, knee, table, dividing head, and tailstock. Both models have proved to be advantageous in meetings where it would be inconvenient or impractical to employ the actual machines. Being light and portable, they are easy to carry to hotel suites, offices, auditoriums or customers' plants.

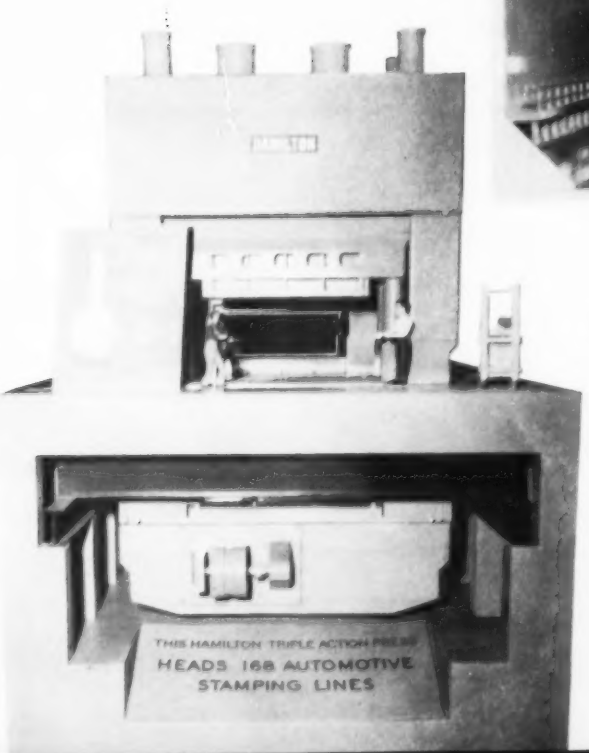
Cincinnati also has a clear plastic model of a face-milling cutter to help visualize tool angles which determine cutter performance. (*AM*—Jan



Press construction... and details of installation are evident in this model of a 75,000-ton Loewy machine. Hydraulic circuit actuates moving members to demonstrate ram action and cycling sequence. Made to a scale of 1 to 50, the model was built primarily for display and demnostration purposes on a machine too big to "see" easily

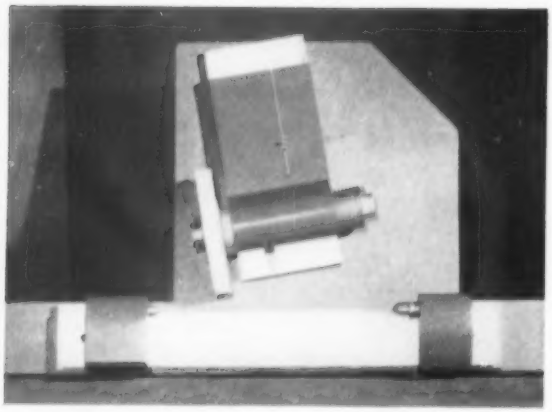
The "throatless" forging-press design . . . of Austin Co and HPM is represented by this movable model which includes a replica of an automatic loader on tracks to carry "work" to the ram. Such models are extremely useful for demonstrating construction and design of such huge machines—and in this case one not yet built



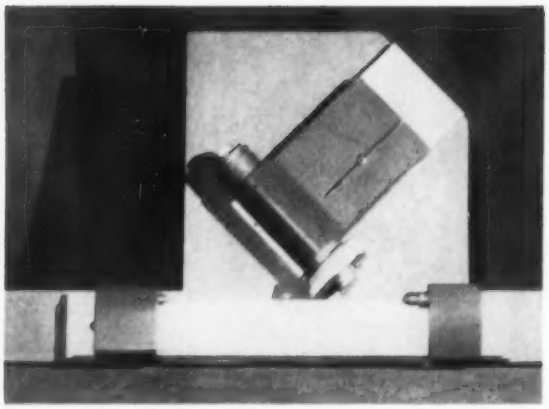


Lubrication diagram . . . combined with a movable model clearly present new features of a Hamilton triple-action press. Cut-away construction of the base points up installation needs while "operators" and fork truck indicate general size

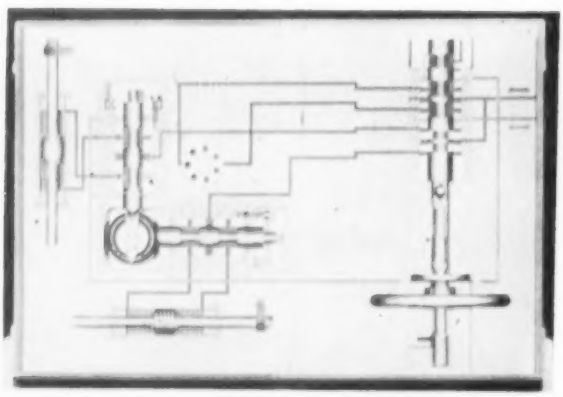
Models are tools . . . not toys

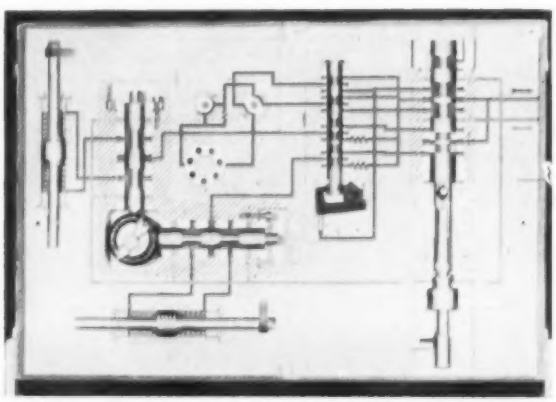


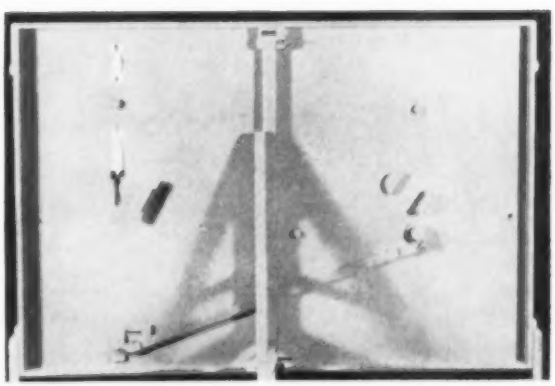
Design principles . . .
are demonstrated by this movable model of a Cincinnati Milling Machine Co adjustable, angular grinding machine wheelhead.



Clearances available with worn wheels are demonstrated as are methods of wheel mounting and other pertinent details

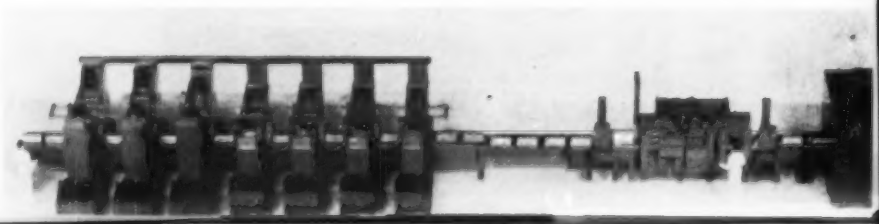






Combination drawing . . .
and 3D movable model is color-coded to show flow of oil in hydraulic circuits. Interchangeable panels permit demonstrating circuits of various types of Cincinnati Hydro Tels. Ports and valves can be opened and closed to trace pressure and drain in systems and the frame is hinged to permit folding up for easy transportation in special carrying case. This lightweight assembly is used for training customer's maintenance personnel

Automatic transfer line . . .
for engine blocks at Plymouth includes one section produced entirely by Ex-Cell-O. The latter presented a model (first shown at the show) to the customer. This series of five strip photos shows sections of the line before they were "folded" into actual floor arrangement. The actual line is two series like this, in parallel



15, '48). A workpiece on which the plastic cutter is mounted was machined with the original cutter. This was stopped in the middle of the cut to leave partially formed chips. The model makes angular relationships of the cutter axis surprisingly clear by means of properly located red segments on which are embossed the names of the five principal angles that control cutting performance and chip flow.

Tooling layouts are simplified at Cone Automatic Machine Co where wooden models are set up in the engineering department. One of these is a full-size section of a TK machine. It saves time previously spent by tool engineers running down to the shop to study clearances, construction, and other elements of the machines for which they lay out tools.

Working models help

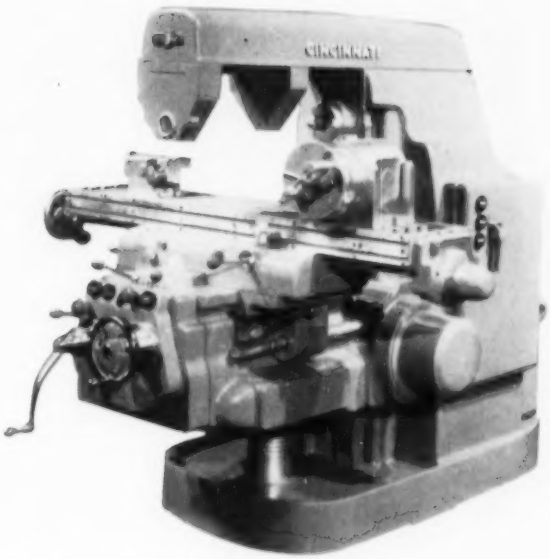
Considerably more complicated, but possibly even more effective than stationary and movable models, are those that actually work. An outstanding example of this type is a 6-spindle Cone automatic made to 1/3 scale—exact in every detail of construction and design. On display at the Machine Tool Show, this model produced small brass screws—clearly demonstrating performance capacities of the equipment it represented.

It was made of materials used in real machines as a spare-time project—using prints, patterns, and a full complement of shop equipment. Cone uses it for numerous displays and advertising projects as well as in industrial shows. In addition, future plans are to take it to engineering meetings, classrooms and similar places to demonstrate operational principles. No maintenance problems are evident—except normal lubrication of moving parts.

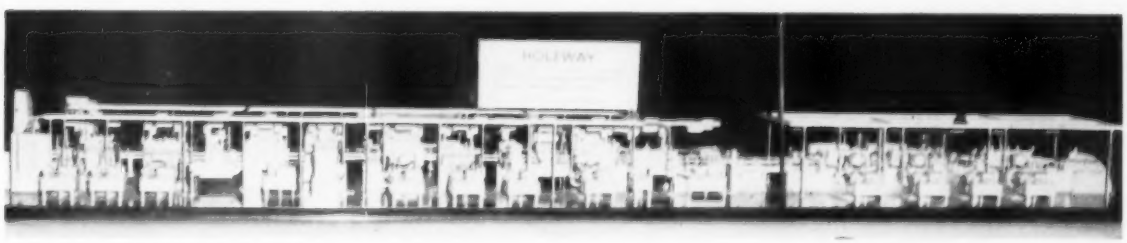
Where they come from

Of course, working models like these are usually hobby projects of mechanics or other interested people—few are made to order because of the tremendous amount of time and expense involved. The simpler models made by company employees like George Schmitz of Cincinnati Milling Machine or John Bendel of Lithium are somewhat more common. Individuals in a plant who know the intricacies of the product and have the time and talent to translate this knowledge into three dimensions are a little scarce.

Many commercial firms can supply most station-

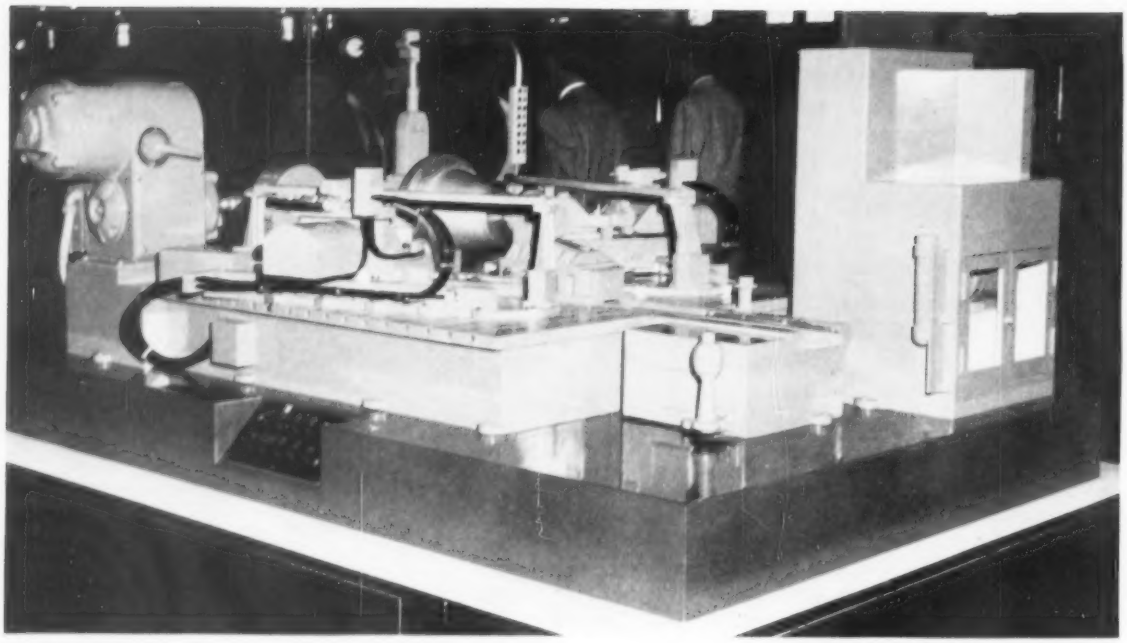


The looks of a real machine . . .
are present in wooden model of a new Cincinnati dial-type milling machine. Used in engineering and sales conferences, all major components can be quickly assembled and disassembled to show features of design and construction. For realism, handwheels, control knobs and levers are actual parts

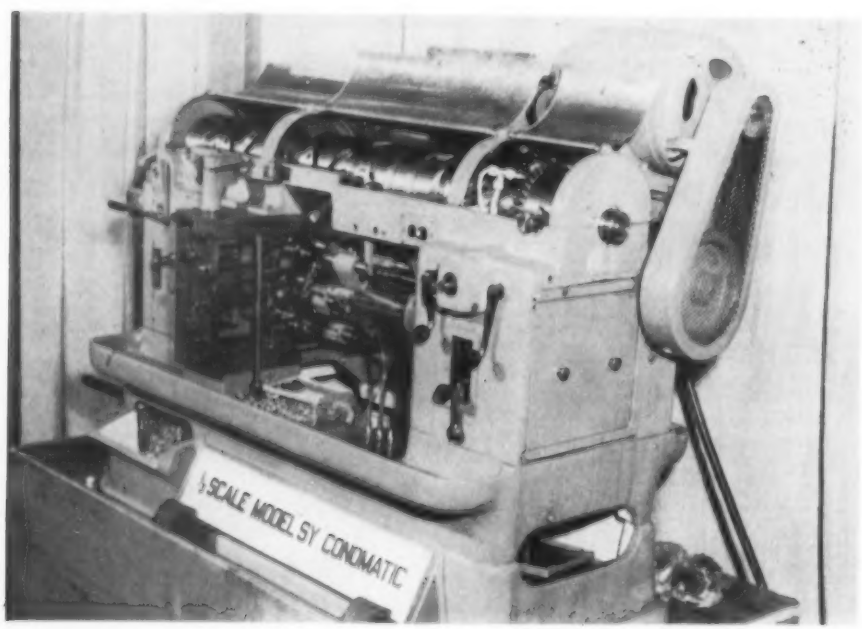


120 cylinder heads per hour . . .
are turned out on the transfer machine of which this is a display model. Made to 1/12 scale, it suggests the size of the original built by Natco

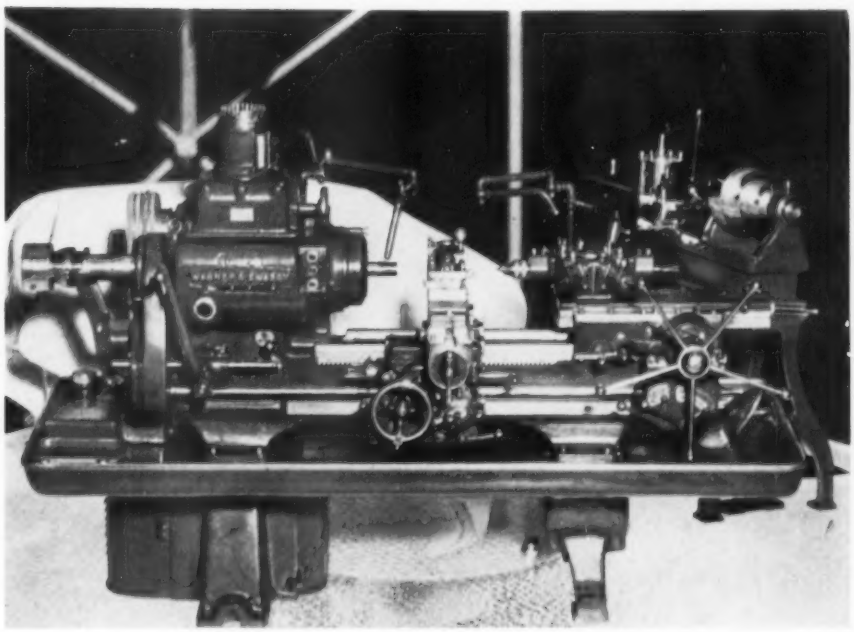
Models are tools . . . not toys



All the controls work . . .
on this operating model of a Cincinnati Hydrospin machine to show complete cycle—although it doesn't make parts. Cincinnati's pattern shop built all wooden parts including the cabinet and base, while other departments contributed metal members such as aluminum ways and the cone. Electrical controls and wiring were also installed by the company. Although this model, like others, was made primarily for exhibition purposes, it provides design engineers with ideas for development



This one actually makes parts . . .
although it is only 1/3 the size of a real machine. Around 2200 hours of spare-time labor at 20 hours per week went into building it for Cone Automatic Machine Co, where it is used to demonstrate principles of operation at industrial shows, technical meetings and schools

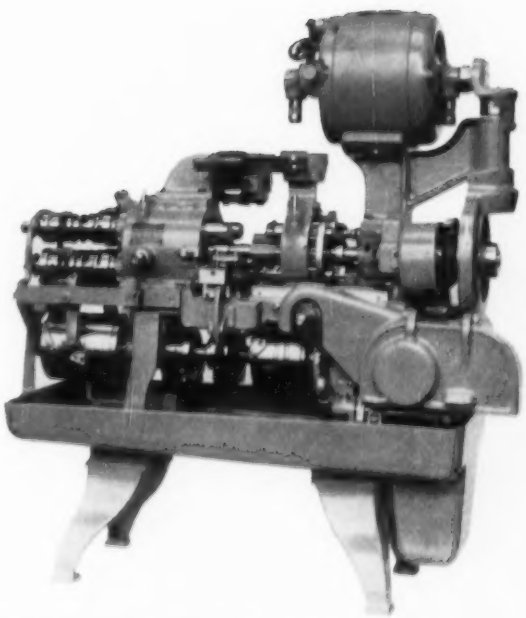


Another working model . . . that illustrates progress in design is this miniature replica of a No 4 Warner & Swasey turret lathe. First machine built by the company in 1880 is represented by the model in the right background. Both were built by company mechanics—are frequently displayed at industrial shows and permanent exhibits

ary 3D models used for planning. Usually, such suppliers will furnish an estimate of the costs. Their personnel will visit the plant and make sketches, or photograph the equipment, or may even work from catalogs or drawings. Unless machines and equipment are of foreign make, a high percentage of such models can be produced from catalog data that well-equipped model builders keep on file. Many have large stocks of models of standard American machines. Prices for 3D layouts run about 2 to 7½ cents per square foot of plant, depending upon size, congestion, degree of detail specified, and the ratio of production to non-production equipment. Quoted price usually includes the cost of visiting the plant and making sketches in preparation for the actual model. As in everything else, greater detail costs more money.

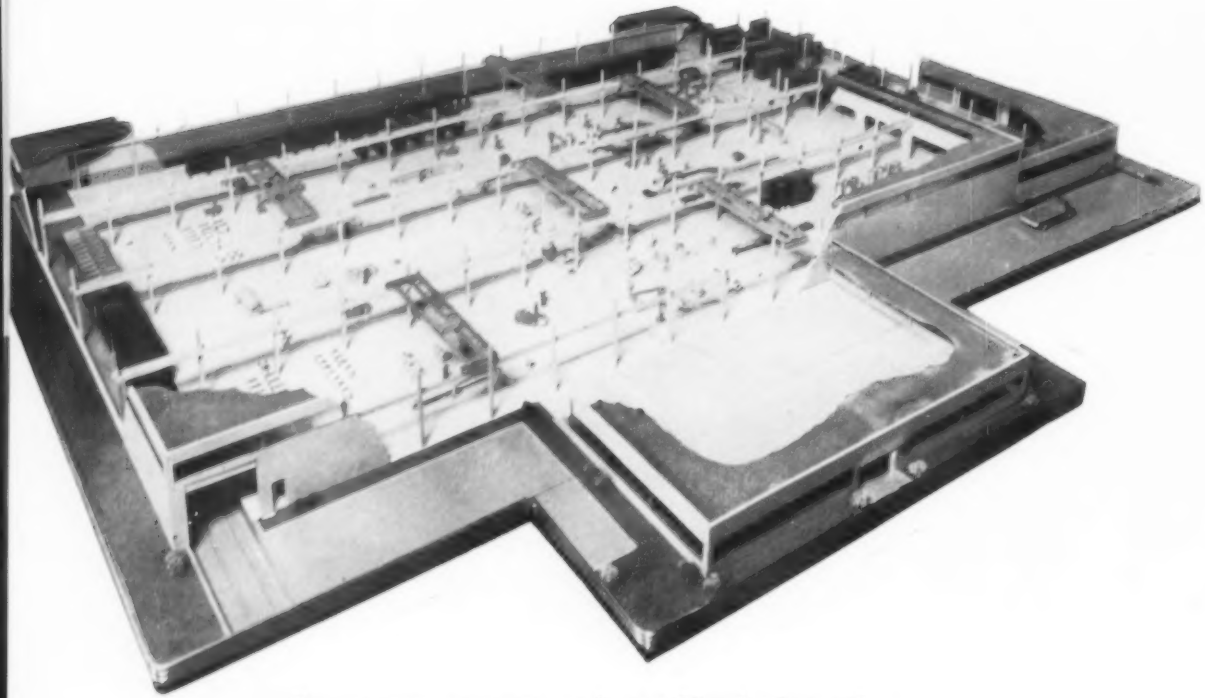
Small standard models

Models, usually of plastic or cast type metal, show over-all dimensions of the equipment. Details are sufficient for easy recognition of various types, and makes of machines and proportions are to scale within reasonable tolerances. Practical tolerances are about 0.010 in., although closer dimensions can be held at higher cost. Commercial model builders can supply planning models in any scale, but for scales selected for layout work in most cases are ⅛ or ¼ in. to the foot.



One-quarter actual size . . . this model of an original Model A Acme 4-spindle No 52 automatic works, too—and can turn out small parts. Like others, this one is displayed at shows and other exhibitions—demonstrates company's progress in machine design. Length across feet is 12 in., height to bottom of motor support is 15 in.

Models are tools . . . not toys



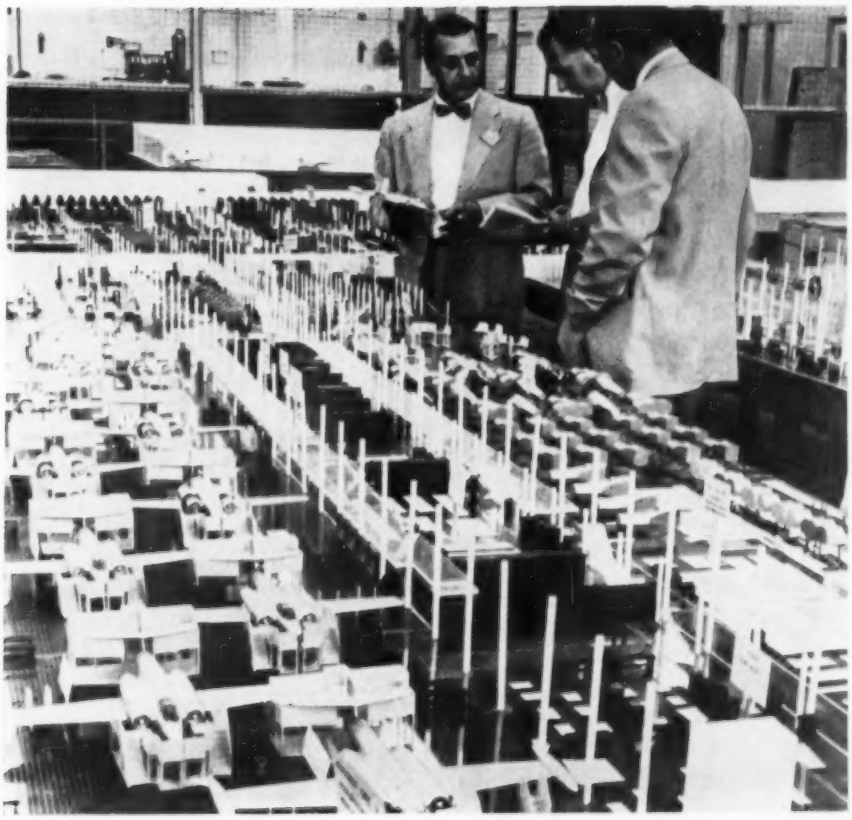
Permanent magnets and metallized plywood . . .
hold machine models securely to the floor in this plant layout but permit easy rearrangement when necessary. Partial exterior walls and roof sections can be removed for planning and returned for exhibition purposes. This ¼-in. to 1-ft scale model of an 81,000-sq ft steel warehouse was built by Knight Models, Inc, so plans for actual construction could be drawn after studying the 3D layout of machines and equipment

Working model of a machine mechanism . . .
helps get the point across to customers. This model of a "backlash eliminator" demonstrates how backlash between leadscrew and nut on Cincinnati knee-and-column type milling machines is eliminated. customers can see and feel difference

Plastic models are easily repaired when broken by patching them with plastic cement—usually supplied with the layout. New temporary adhesives are available to permit fastening such models securely so they are not disarranged if the layout is jarred, yet they can be moved at will. These adhesives also allow models to be stacked vertically along a wall, requiring far less floor space than horizontal storage. Heavier cast type-metal models do not require adhesives if the layout is kept flat because they stay in normal position of their own accord.

What models include

Complete layout models include floor plans accurately scaled to plant dimensions, permanent interior walls, columns, stairwells, elevator shafts, partitions, outside walls with door and window openings, as well as all the production machines. Material in storage, work in process, finished parts, railway tracks, and truck docks are often included at little additional cost. Base plates may be wood, plastic, or other materials, gridded or not as desired.



A 500,000-sq ft aircraft plant . . .
planned with 3D layouts includes work in progress as well as machines and equipment. Built by Visual Plant Layouts, Inc, for A V Roe Aircraft in Canada, the layout simplifies production changes, permits easy discussion of new ideas by non-technical as well as technical men

What a maker needs to know

To get an estimate, (if you don't have reliable drawings or lists readily available) a model maker will want:

1 . . A list of production machines (including manufacturers' names, model numbers, number of spindles, heads, etc.)

2 . . A count of all non-productive equipment, (conveyors, bins, lockers, tables, buggies, loaded pallets, etc.)

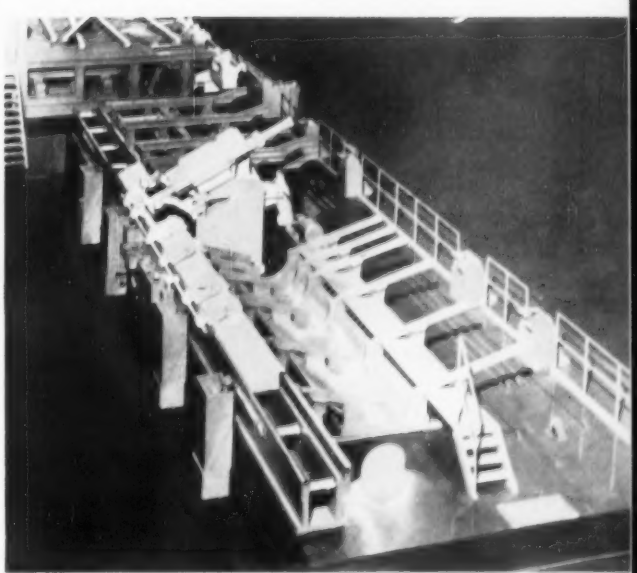
3 . . Number of pieces of work in process that are big enough to show, that is—over 12 in. in diameter.

4 . . Floor plans of building or the area to be modeled and the number of bays.

5 . . Specific scale desired.

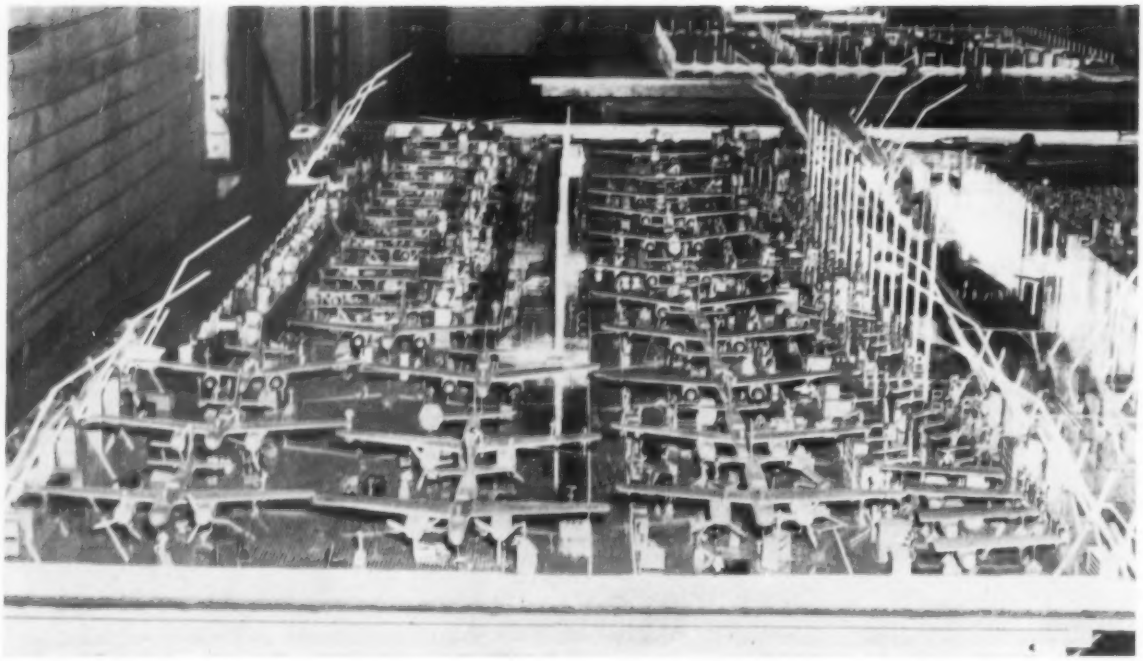
6 . . Omit bench tools and small items not significant in planning.

Importance of the proper planning of plant layouts is indicated by the organization of a "plant-layout technical workshop" by one model builder for training plant-layout engineers. Held twice a year in Pittsburgh by Visual Plant Layouts, Inc, workshop sessions last a week.

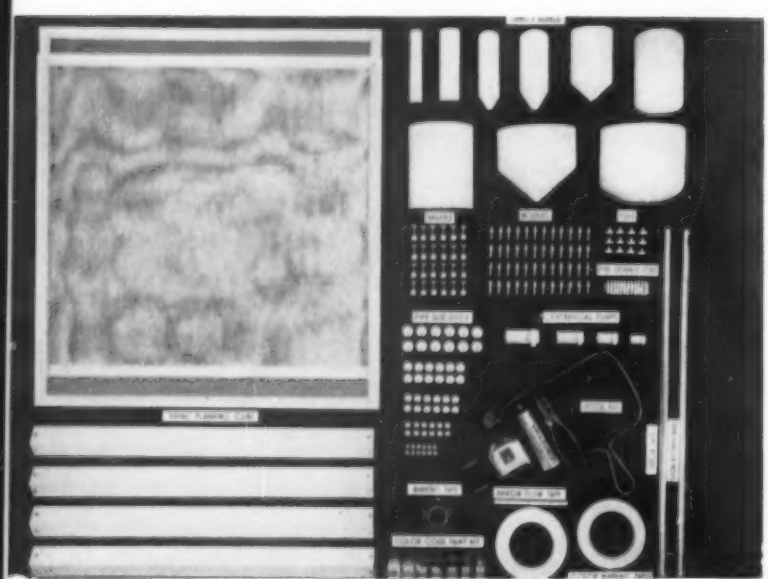


Working model of a billet chipper . . .
was made for Continental Machine & Foundry Co by a commercial builder

Models are tools . . . not toys



Most AMC Bases . . .
of the Air Force now have 3D plant layouts. These are used at Hill Air Force Base, Ogden, Utah, and were made by Visual Planning Equipt Co, Inc

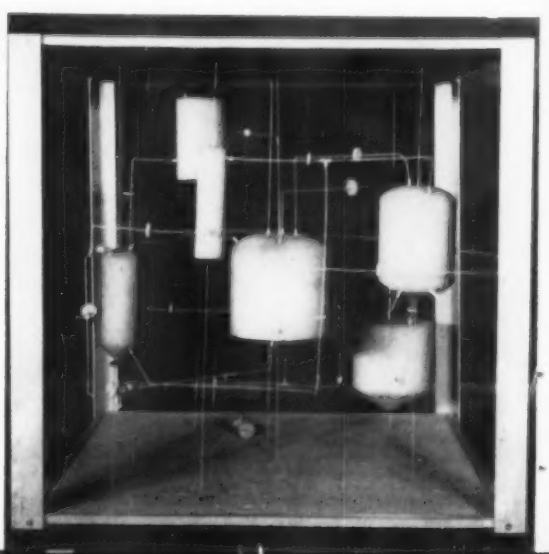


"Planning in space" . . .
is easy with this commercially available cube setup for layouts. Kit at left includes everything necessary to build layout assembled at right. Wire "piping" shows flow—disks indicate pipe dia and valves are clipped on at desired points

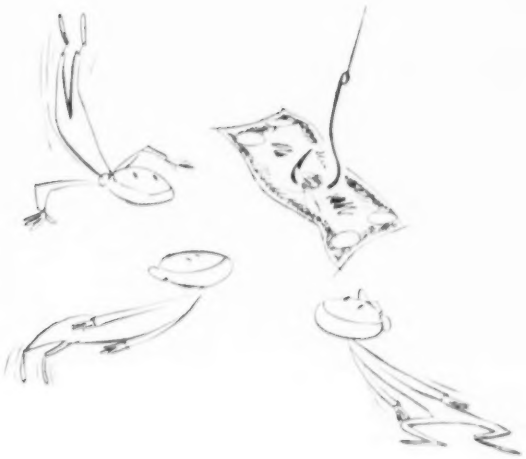
Acknowledgments

We gratefully acknowledge assistance of the following companies in preparation of this article:

The Cincinnati Milling Machine Co, Cincinnati, Ohio
W F & John Barnes Co, Rockford, Ill
The Lithium Co, Newark, NJ
F Ward Harmon Associates, Halesite, NY
Knight Models, Inc, Chicago, Ill
Visual Planning Equipment Co, Oakmont, Pa
Industrial Models, Inc, Wilmington, Del
American Broach & Machine Co, Ann Arbor, Mich
The Ohio Machine Tool Co, Kenton, Ohio
Landis Machine Co, Waynesboro, Pa
Snyder Tool & Engineering Co, Detroit, Mich
Sundstrand Machine Tool Co, Rockford, Ill
The Hamilton Tool Co, Hamilton, Ohio
Gould & Eberhardt, Inc, Irvington, NJ
Cone Automatic Machine Co, Windsor, Vt
The Warner & Swasey Co, Worcester, Mass



Round Table



Loan Shark

"I've got a real loan shark in my department, Ed. I just found out that Mills has been lending money to the men when they're broke, and charging 10% a week interest."

"So what? Just forget it, Al. It's none of your business. If your boys are stupid enough to borrow money like that, let them take the consequences."

"But that's illegal, Ed. If I don't watch out they'll have federal cops crawling all over the place. I'm going to report it to Personnel and let them handle it. I can't get anywhere with Mills."

"Better leave it alone, Al. The men won't particularly appreciate your efforts, especially if they'd have trouble borrowing dough from any respectable source."

"Well, would you just forget it if one of your men was doing it?"

"Sure, and I have, too. I remember a couple of times I heard about similar cases; but I didn't do anything about it, and it quieted down. I suppose the men realized I wasn't going to baby them, and they just finally had to make up their minds to spend their money more wisely. Sometimes you can do a guy a favor by not helping him at all, you know."

"I'm afraid I'll get into trouble with Management if I don't do something about it. Harrison will blow his top."

"Maybe so, Al; and maybe not. Did one of the guys who's been borrowing from Mills make a complaint, or did you hear about this through the grapevine?"

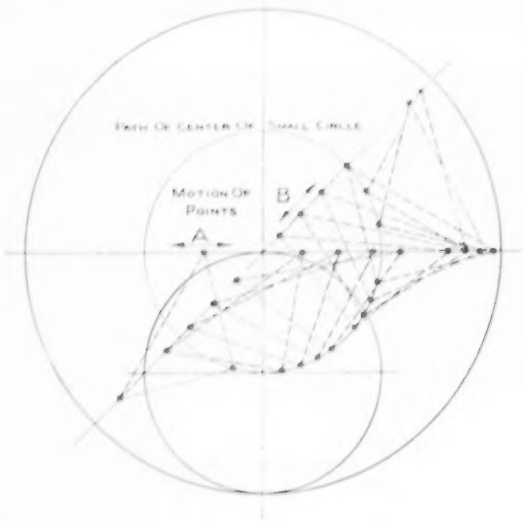
"Well, it was one of my pet busybodies, as a matter of fact—just shooting off his mouth, as usual."

"Then forget it—unless somebody makes an official stink."

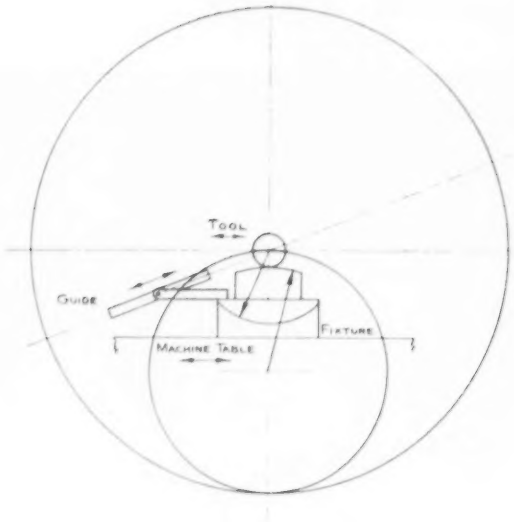
"Maybe I should just fire Mills myself. It seems like a good enough reason."

"You're liable to get into a mess of trouble, Al. Keep your shirt on; it'll die down after a while. Why lose a good worker just because he's temporarily exicted about making a killing?"

***SHOULD AL** fire Mills, report him to Personnel, or just ignore the whole thing? Your opinions may aid others with similar problems. Discussions of earlier topics start on page 180.*



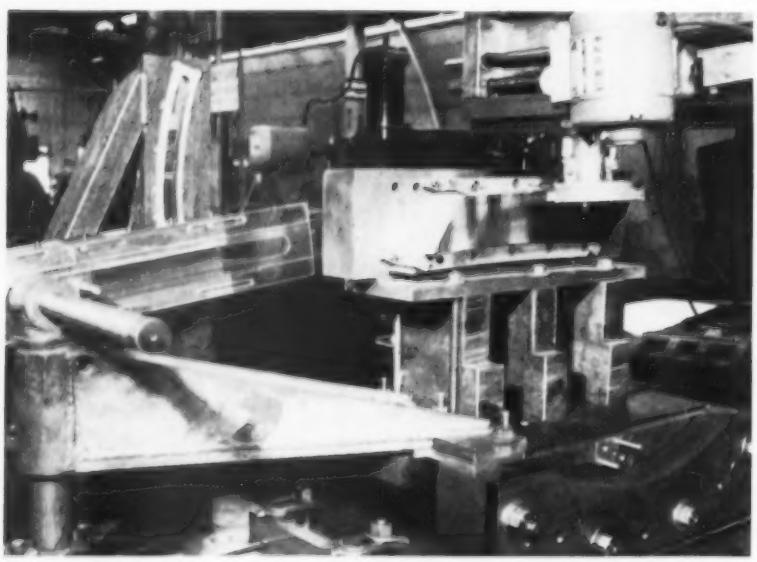
GEOMETRIC PRINCIPLE of fixture is that when two circles, one twice the diameter of the other, and positioned so the smaller rolls around inside the larger, any point on the circumference of the smaller circle moves along a diameter of the larger



PRINCIPLE IS UTILIZED with machine table and ways serving as one diameter and the guide as the other. The two points on the small circle are the center of the arbitrary rocker radius and the pivot of the torque arm

Fixture generates large

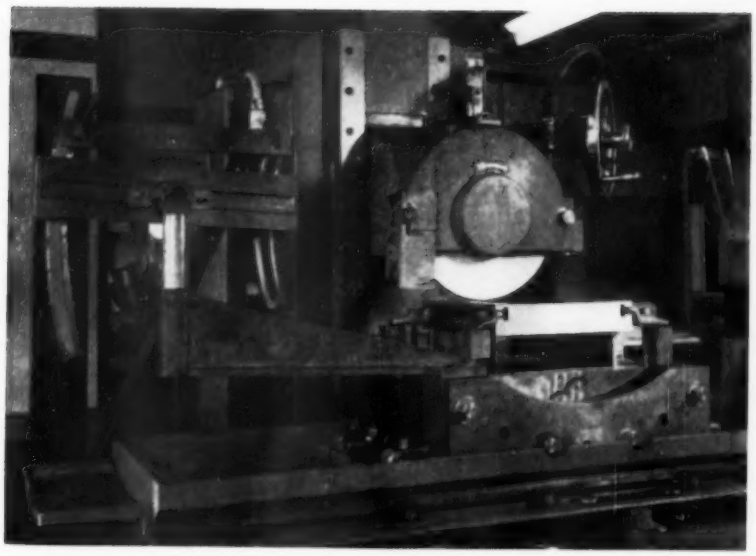
Built on an old geometric principle, this fixture will generate a radius over a large range of sizes. It is delicate enough to permit precise adjustment, yet rugged enough to hold size during heavy machining



CONICAL SURFACE is finish ground in the fixture with this setup

A fixture that will generate a true circular arc with good accuracy, reliability, and is adaptable to various standard machine tools, was constructed of Meehanite castings. It followed standard toolroom practice, the dimensions being selected with possible future use in mind, as well as the job at hand. It consists of four parts: base, rocker, guide, and torque arm.

The base, with its rocker, is mounted on the machine-tool table, and moves with it. The guide is mounted stationary on the machine-tool frame, the torque arm being mounted on the rocker, and its pivot and slide riding in the guide. With the guide set at an angle, and the machine table in motion, the torque arm imparts an oscillating motion to the rocker. As the work, mounted on the rocker,



RADIUS OF 26.5 FT is generated here on a surface grinder by utilizing the fixture

radius

HERBERT OSTRANDER, associate mechanical engineer, Central Shops,
ARGONNE NATIONAL LABORATORY, LEMONT, ILLINOIS

passes under the tool placed at the center of the rocker radius, the tool describes an arc in relation to the work. The attitude of the guide in respect to the rocker center determines whether the arc is concave or convex.

The fixture operates on the well-known geometric principle that if two circles, one twice the diameter of the other, are so positioned that the smaller rolls around on the inside of the larger, any point on the circumference of the smaller circle will move along a diameter of the larger.

It follows then that if two points on this small circle are constrained to move along two diameters of the large circle, the path of the center of the small circle is determined, the distance between the points and the angular relation of the large circle diameter determining the radius of the path, and therefore the diameter of the small circle as well as the large circle.

To utilize this geometrical fact, the fixture is designed so that the work will occupy a position at an arbitrarily convenient distance from the center of the large circle (determined by available machine capacity and dimensions of maximum work) and be fixed to the small circle so that it will rotate with it.

The machine-tool table and ways function as one large circle diameter, and the guide is the other. The two points on the circumference of the small circle are (1) the center of the arbitrary rocker radius, and (2) the pivot of the torque arm, which slides back and forth in the guide.

The spindle of the machine is set at the center of the large circle, if a rotating tool such as a (grinding wheel or milling cutter) is used. In this case an arc will be generated which will be the calculated radius minus the radius of the tool.

A derivation of the relationships of the three selected elements will show that $R = \frac{L}{2 \sin \theta}$, where R is the radius of the small circle, L is the chordal distance between the two points on the circumference, and θ is the angle between the two diameters.

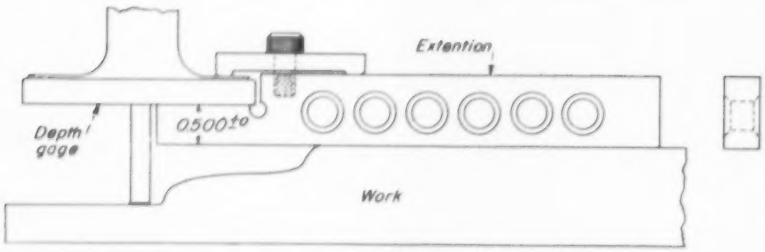
The accuracy of the fixture is very satisfactory, the greatest difficulty being in checking the work produced to a degree of accuracy which will match that of the fixture.

Percentagewise, the accuracy increases rapidly as the length of the radius increases, and the chordal height must be measured with increasingly greater precision.

In practice, this device has proved a welcome attachment in the machine shop, and takes its place along with the dividing heads, rotary tables, etc, providing a convenient, standard, and relatively simple means of generating accurate radii of large dimensions.

We are indebted to Dr Jesse W DuMond, Department of Physics, California Institute of Technology, for the practical application of this geometrical principle and the full description of the prototype of this fixture, published in *The Review of Scientific Instruments*, Vol 18, No. 9, 617-626, September, 1947, as well as for his personal guidance and counsel in its construction and use.

Practical Ideas . . .



Depth-Gage Extension Helps Measure Hard-to-Get-at Places

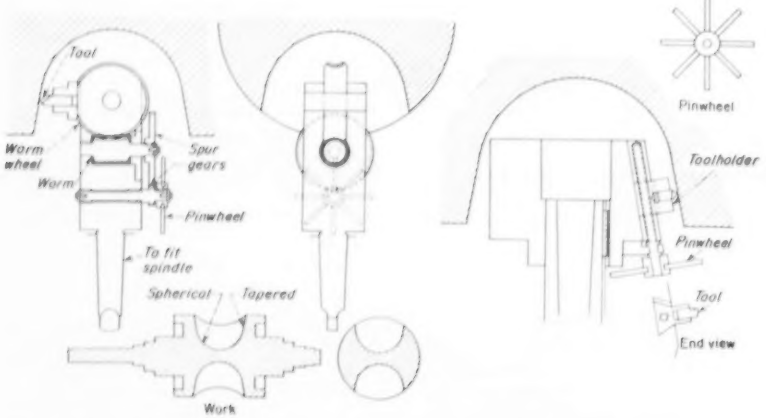
Did you ever find the beam of your depth gage too short to span a particular hole or cavity? The illustration shows how the problem can be solved, and the use of parallels neatly eliminated.

The material is a piece of $\frac{3}{8} \times \frac{7}{8}$-in. ground oil-hardening stock, 5 to 6 in. long. A step is machined in it, leaving 0.500 in. plus a few thousandths for grinding. Drill and tap for a 10-32 clamp screw on top, then drill and countersink a few holes through the body to make it lighter and better gripping.

Harden and grind all over, making the gage rest 0.500 in. Finally, make a clamp and knurled thumbscrew to hold the gage.

In use, subtract 0.500 in. from the gage reading.

H Kalldin, Brooklyn, N Y



Boring Tools Cut Taper and Radius

Two opposite spherical holes with outward-tapering sides were required in shafts we were making. To cut these holes we made two special boring tools that work to high accuracy through geared drives.

Work was mounted on a horizontal boring machine table, and each tool was set up in the boring spindle in turn. First job was turning the spherical seat.

This tool was made up with a slotted arbor, inside of which a worm wheel rotates. The worm has a sector machined away where we located a single-point boring tool, fitted with suitable adjustments. A worm gear at right angles to the wheel is mounted through a hole in the arbor, and the end of the gear shaft has a spur gear attached. This meshes with another spur gear that is keyed to a cross shaft fitted with an eight-spoked pinwheel.

The boring machine rotates the arbor, as usual, and the pinwheel is caught each time the arbor revolves by a detent pin attached to the machine frame. This indexes the pinwheel $\frac{1}{8}$ turn each time the arbor revolves, and drives the work wheel and toolbit in a circular path, through the spur gearing. Feed is fairly slow, so the machine can be run at a good rate of speed.

This same arrangement of pinwheel and detent pin is used with the second tool, which machines the tapered portion of the hole, which leads into the spherical seat. In this case the arbor, which replaces the first arbor in the boring-machine spindle, is fitted with a cast-iron body that is dovetailed for a sliding toolholder. This has straight-line motion, and is lined up to follow the taper required.

The same pinwheel arrangement rotates the screw running through the toolholder body, which feeds the tool to cut the taper as the boring spindle revolves.

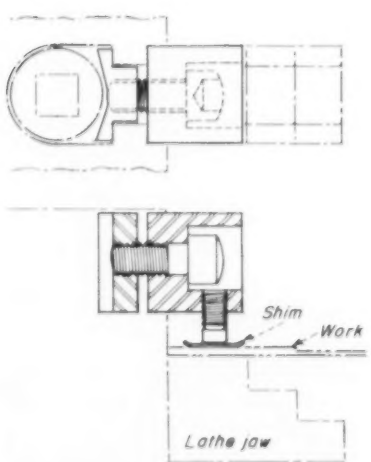
B J de Bruyn, Enschede, Holland

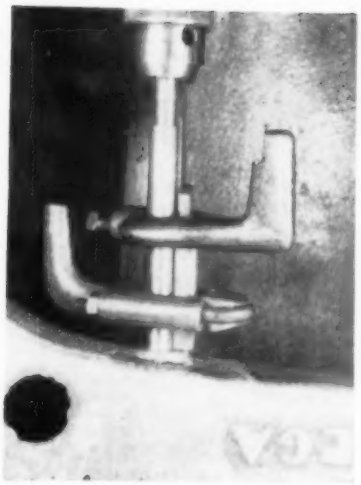
Auxiliary Jaws Helpful In Holding Light Work

Thin-walled short lengths of tubing or rings are always hard to hold in a lathe chuck without distorting. I therefore designed this auxiliary jaw to grip the work from the outside, while the chuck jaws will supply the pressure from inside.

The auxiliary jaw is made up of a T-nut and a block that holds the adjustment screw. The two parts are locked in place by a socket-head capscrew.

Leonard M Maunu, Milwaukee, Wis





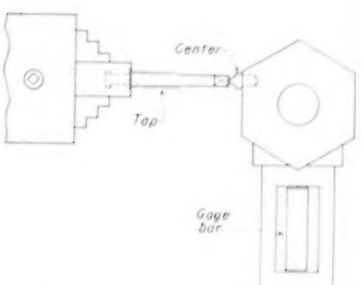
Emergency Spotfacer Uses Standard Bit

Drilled bosses can be spotfaced and holes can be counterbored with this emergency tool. It requires a mild-steel pilot to fit the hole, a clamp, lathe dogs, and a lathe toolbit.

These are assembled as illustrated. The toolbit is square on the end to start with, but has relief ground into it. Side clearance is necessary, so the side of the tool is also ground; especially if the tool must counterbore below the surface of the work.

Assembly takes only a few minutes.

H J Gerber, Oklahoma A & M Stillwater, Okla



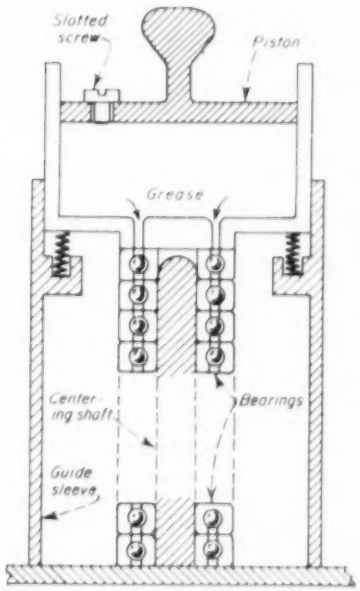
Turret Locating Bar Provides Accurate Center

We tap gage-fitting holes with a turret lathe because we have equipped the turret with a permanent accurate center. It doesn't interfere with any of the tool holes, and allows all normal turret operations.

A piece of bar stock was located in the gap between the turret and the cross-slide member, right over the cross-slide spindle. This acts as a gage any time we want to use the center.

The hole was drilled a thousandth or two undersize for the stub center, allowing a press fit. As installed, the center is helpful for tapping, and reaming, too, if a suitable driving mechanism is attached.

R Johnson, Glasgow, Scotland



Hand Pump Loads Greased Bearings

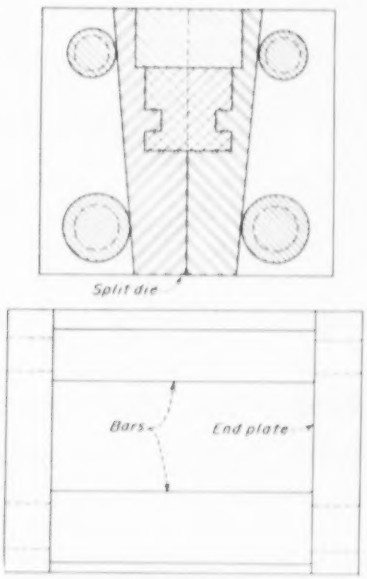
From 15 to 20 small ball bearings can be greased simultaneously with this bench pump. It acts on the principle that air will flow readily through the fairly tight openings in bearings, but grease will not.

Pressure on the piston forces grease down from the reservoir through several holes in the bottom of the grease cup. Grease then goes down around the bearing balls in all bearings until all are full. At this point, the grease stops—you can feel the sudden pressure buildup.

The pump requires a baseplate, guide sleeve, central centering shaft to fit the bearings, and holes in the grease cup to suit the bearing dimensions.

After the bearings are greased, the slotted screw is backed off to allow raising the piston.

M Ando, Himeji City, Japan



Simplified Plastics Die Uses Bars for Bolster

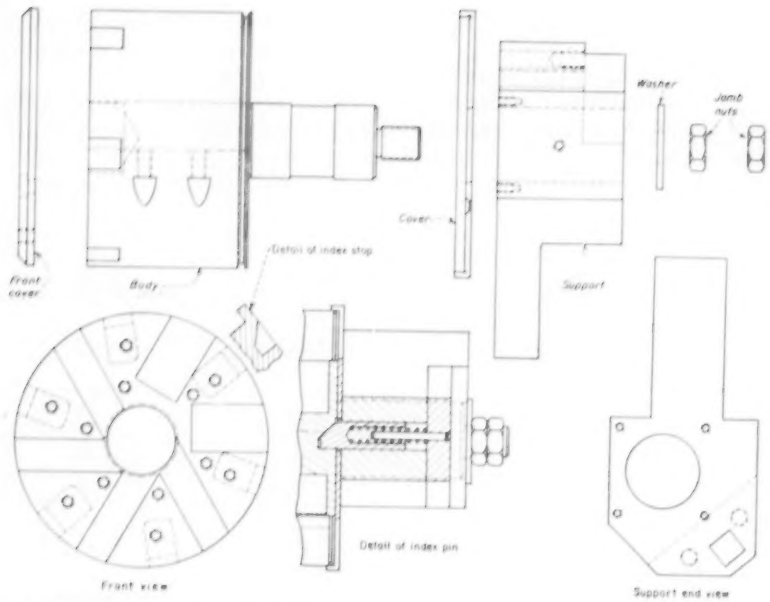
Short-run dies for small plastic parts can be made up much simpler than normal die practice requires.

Instead of making a complete die bolster with internal taper for a split die, we hold the die between two end blocks, and support it on the side with bars, as illustrated. This still allows easy die ejection and die splitting to get the part out; but eliminates taper machining on the bolster.

The bars are shouldered, hardened, and ground; then pressed into the end plates. The centers of the holes can be made vertically above each other, and bars of two sizes used—thus producing a tapered die support. Equal bars can also be used, with centerholes offset; but this makes layout more difficult.

End plates and bars are case hardened. All parts are simple enough that they make replacement an easy matter.

A V Reed, Letchworth, England



Add More Stations To Your Turret With Rotary Indexing Toolholder

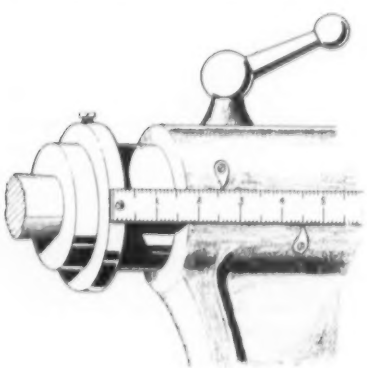
We needed five more stations on the square turret of a turret lathe. To solve this problem we designed a rotary indexing toolholder with a shank that slips into one side of the turret, replacing a regular tool.

We have ten tools in our holder; two sets of gang tools, three per set, for roughing and finishing three different diameters; one facing tool, one turning tool, one threading tool, and one forming tool. Counting our original square turret positions and six stations on the hexagonal turret, we have a total of fifteen stations now in operation.

The two gang-tool positions have throwaway tips and shanks. These are bolted and doweled together, and once clamped into position, require no further attention. The other four stations hold ¾-in square toolbits.

If no gang tools were to be considered, the over-all length could be reduced and the rotary holder would carry six tools instead of ten. This holder is positively indexed by hand, but could be indexed automatically. The indexing pin absorbs rotary thrust from the work. It has reduced handling and increased production 30%.

Paul H Gotstein, Baker Oil Tools, Los Angeles, Calif.



Tailstock Scale Makes Lathe More Useful

We fasten a steel rule to a collar clamped on the tailstock spindle to allow drilling and reaming to specific depths. This is necessary where the tailstock spindle has no regular graduations.

More than one index pointer can be utilized; especially if the same work is to be drilled and reamed to different depths.

Rolf B Ericson, Trollhattan, Sweden

Winner No. 249

Three-way tie:

ROBERT MOORE
GEORGE G HERZL
GEORGE F OLIVER

won $25 in addition to regular payment for their ideas:

BOLT CIRCLE WITHOUT HEAD
LOW-COST JIG
THREE-WAY JIG CLAMPS

In the Issue of April 23, 1956

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

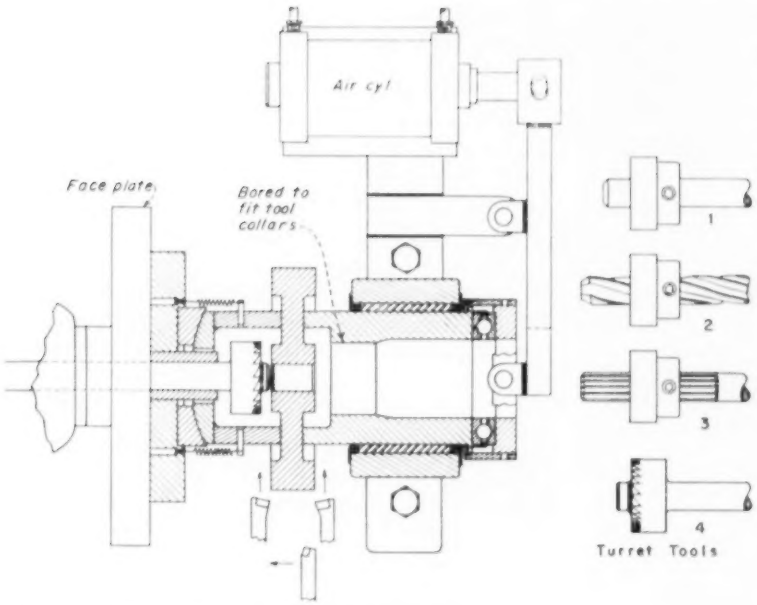
PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y



Turret Lathe with Air Vise Machines Gear Blank All Over

If you have the problem in production where you have to turn out gear blanks or other work of that nature with the least amount of handling, you may solve it the way we did here.

We had to face each side of the hub and rim, turn the OD, and finish the bore on aluminum castings.

A round plate is secured to the faceplate, then machined to take a hardened guide bushing and a commercial self-aligning spherical washer. A section of tubing is welded to the mating member of this washer. This assembly is held together by four springs.

The vise assembly is made up of the baseplate, short-stroke air cylinder, and bearing block that carries a bronze bushing protected by felt oil seals. A sleeve which rotates with the work rides in this bushing and the back end of this sleeve bears against a sealed ball thrust bearing. Finally, a ring actuated by the lever applies the holding pressure.

The tools used with this fixture are shown in the drawing.

Turret tool No. 1 centers the work before clamping pressure is applied, No. 2 is a core drill, No. 3 finishes the bore, and No. 4 is a piloted tool which faces the hub. These tools carry collars that are guided in the clamping sleeve.

Three tools in the cross-slide turret turn the OD and face each side of the rim.

A cutter similar to turret tool No. 4 is used to finish the back face of the hub. It is guided by the hardened bushing on faceplate, and the shank which extends through the headstock, and is operated by a lever. A collar adjusted on this shank butts against the back end of the spindle as a stop.

The two sleeves are notched on the ends to provide a better hold on the work and also to allow coolant to enter.

Clifford Molloy, New York City, N Y

Protect Chrome With Carbon Black

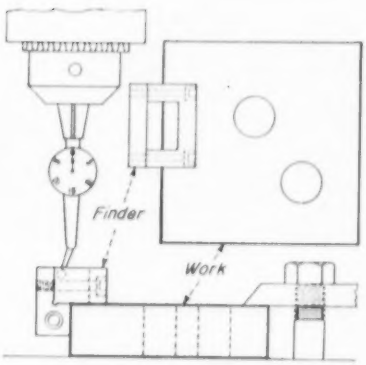
When welding or torch-heating small areas close to areas that are chrome-plated, adjust the torch to an oxygen-starved flame and coat the chrome with carbon first. Then do your welding. Afterward, the carbon can be removed with a cloth.

Harvey Muller, Danboro, Penna

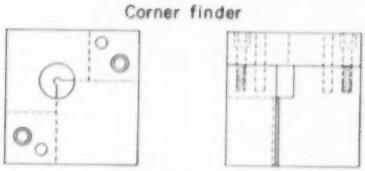
Safer Strip Deburring

Take an ordinary kitchen knife sharpener and add a handle or two so you can stroke it along the rough edges of sheet metal. It does a quick job, and is safer than many other kinds of deburring tools.

Stanley Clark, Bradenton, Fla



Corner finder



Two Tools Find Edge And Corner Quickly

While working on milling machines and jigborers, I found the need for accurately finding the finished edge of the work. Here's how I solved the problem.

I made up two blocks, one for picking off a single edge, and one for picking off a corner. The single-edge block is made up of two pieces. Sizes can vary to suit your needs, just so long as the recess in the top piece is exactly twice the depth of the step on the other part to which it is bolted.

The corner block is also made in two parts. Machine an angle of exactly 90°, then recess the center part to give clearance under the pick-off hole in the top plate. This plate has to be doweled to insure accuracy.

When all machining is done, harden and grind all surfaces. Assemble corner block before grinding pick-off hole in exact alignment with the inside bearing surfaces.

Albert H Provost, Ludlow, Mass

Unusual Machine-Shop Job: Stone Cutting On A Lathe

We do a lot of experimental work in our shop; one of our recent jobs was turning limestone cylinders for use in petroleum-industry research. These had to be machined to close semi-precision tolerances.

Our first try at handling the blocks was to rough them down with a pneumatic chisel. Then we chucked them in the lathe and turned them with a carbide tool, but this wasn't successful. The tools would wear at a rapid rate and develop a highly objectionable fine dust.

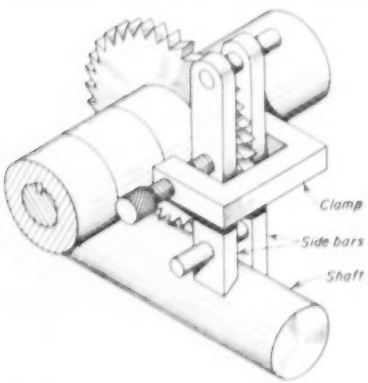
The rotary tool shown was made from an old HSS form tool blank, fitted with a bronze bearing and felt seal rings to keep out dust. An oiler should be added for sufficient lubrication.

Mounted on a shank, it is held in a standard boring toolholder and presented to the work at an angle found experimentally. A speed of 80 RPM (on 12-in cylinders) was used for roughing with cuts about ½ in deep, while a speed of 285 rpm was used for finishing.

This tool has been successfully used to re-size vitrified grinding wheels and to turn some types of granite and other stone.

A ball-bearing pad was made to keep work pushed tightly into chuck. Though this is not a metalworking project, I hope that our experience may serve to help some reader out of a jam, for I know that machine shops do at one time or another receive some strange requests.

H J Gerber, Stillwater, Oklahoma.



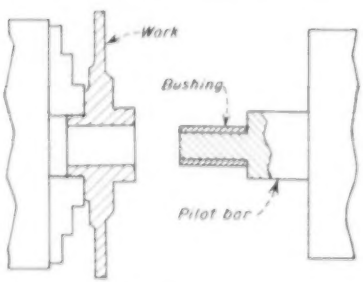
Cutter Guide Finds Shaft Center

Keyway cutting can be simplified with this sort of gage, which clamps on the cutter and centers it above a shaft as the cutter is lowered. Most important points are that the side bars must be the same length, and the V-edges must be equal.

The guide pins simply align the two side bars with each other, while a C-clamp holds them to the sides of the cutter. In the original model, the end of the clamp was bolted to its side bar, making the assembly permanent.

The V-edges make visual setup easy, but for high accuracy the paper-strip method is useful. After the bars are in place, and the cutter roughly located, put strips of paper under each bar, between the bar and the shaft to be cut, and gage the amount of force required to slip them out after the gage is brought down solidly on the work. When tensions are about equal, the gage and cutter are centered.

C T Bower, London, England



Turret Lathe Becomes Press

We had the time-consuming job of pressing in bushings in machined parts. It meant we had to handle all parts once more after machining was completed to do this operation, but only until I came up with this idea, as shown.

A pilot bar was turned from a piece of mild steel and fitted to the hexagonal turret. Its forward end was machined to take the bushing, allowing 0.004 in. for shrinkage when bushing was pressed in. A shoulder was left to serve as a stop against the work.

When we had finished the machining operation, all we had to do was turn the turret to engage the pilot bar, mount a bushing on it, and press it in. Pressure was provided by the turret turnstile.

Philip E McCafferty, Stanwood, Iowa

Hole In Boring Bar Makes Measuring Easy

When faced with the problem of measuring the bore in a cylinder or bearing, with the boring bar in position, we drilled a hole in the exact center of the bar, just ahead of the tool. The hole should be large enough to give ample clearance for the inside micrometer.

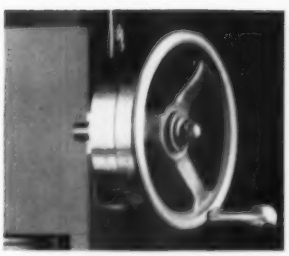
This little shortcut will save a lot of time, as well as frayed nerves, when the need for removing the bar to take a measurement is eliminated.

Bert Palmeter, McDonald, Ohio

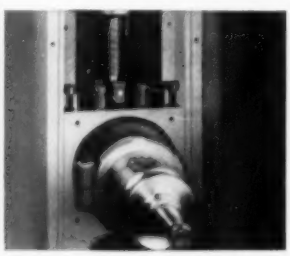
FOOTBURT

Accurate grinding for small parts

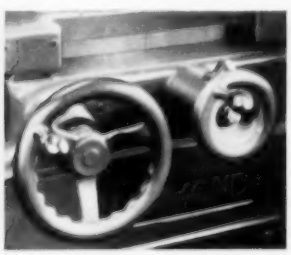
■ The Hammond No. 2, 6" x 18", Surface Grinder is a precision tool room machine for use on the most accurate gauge and tool work. The standard spindle is direct motor driven and is mounted on precision preloaded ball bearing. Total vertical adjustment is 10¾". In and out movement of table is 6½" with a longitudinal travel of 18".



ACCURATE SPINDLE ADJUSTMENT—Standard vertical adjustment of spindle through handwheel is .0005". With Vernier attachment, spindle can be raised accurately to .00005".



SOLIDLY SUPPORTED SPINDLE CARRIER—Spindle carrier is moved vertically on double dovetail ways with adjustable tapered gibs.



CONVENIENT HAND CONTROL—Handy wheels for cross travel, accurately gauged to thousandths, and quick acting longitudinal travel.

SMOOTH ROLLER CHAIN TABLE DRIVE—Remarkably smooth finish on work without chatter marks frequently found when table is moved by conventional means through rack and pinion.

Write or wire for further information.

THE FOOTE-BURT COMPANY • **Cleveland 8, Ohio** • Detroit Office: General Motors Building

FOOTBURT

SURFACE GRINDING

INCREASE GEAR SHAVING OUTPUT *with* VERSATILE SEMI-AUTOMATIC LOADING

The operator handling a conventional rotary gear shaving machine is required to make 7 separate motions for each work part shaved.

With semi-automatic loading this is reduced to just 3 operations.

1. **Place work gear on the pre-locater.**
2. **Press the start button.**
3. **Remove the shaved gear.**

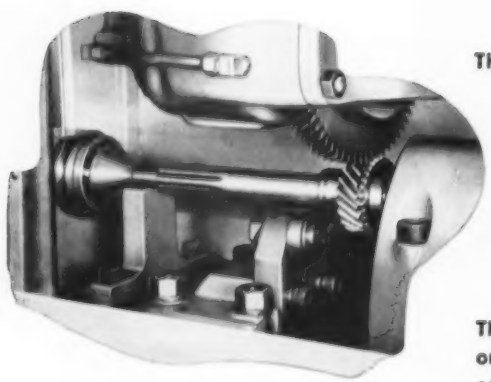
The rest of the cycle is automatic.

Results are:

- **Higher production**
- **Lower machining costs**
- **Less operator fatigue**
- **All the versatility of conventional shaving**
- **Greater safety**
- **Operator has ample time to serve 2 or more machines**

The approximate work locater and head and tailstock centers or plugs are the only work part changes that are additional to a conventional gear shaver.

Red Ring Shaving Machines, Models GCU and GCI may be equipped with this equipment.



Write for Estimated Savings on Your Particular Operation.

Plastic Splash-Guard Used for Demonstration Only.

ORIGINATORS OF ROTARY SHAVING

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

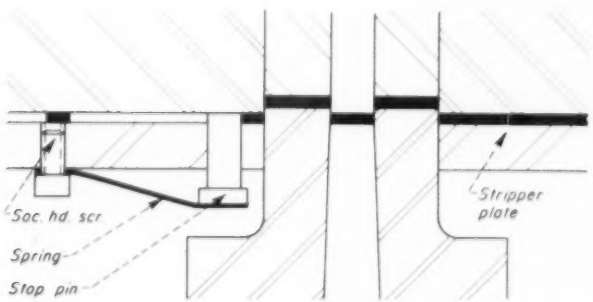
7388 *WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT*

Flat Springs Improve Tools . . 1

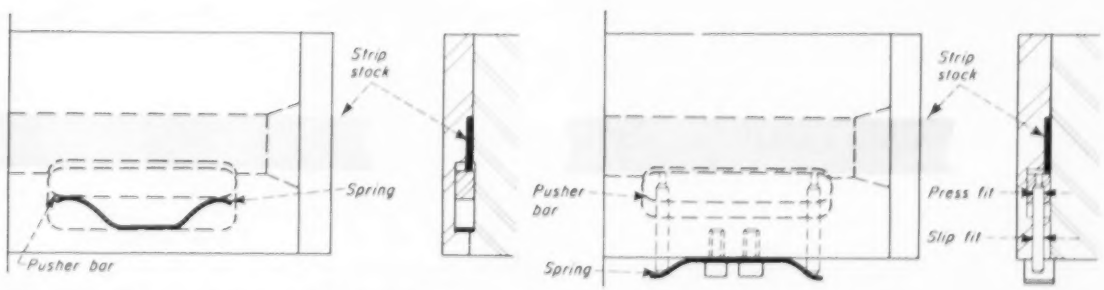
ALLAN YOUNG, tool engineer, COLLINS RADIO CO, CEDAR RAPIDS, IOWA

Beryllium copper can be used to great advantage in all types of tools and dies requiring miscellaneous springs. In most cases, flat beryllium-copper springs will prove superior to coil springs in that dirt, heat, and oil do not lessen their efficiency, especially in drill jigs and soldering fixtures. The diemaker also will find that strips of beryllium copper will be much easier to store and keep track of than an assortment of miscellaneous coil springs. They can be shaped easily, then heat treated at 600 F for about 2 hr to develop spring properties.

The thickness and width of beryllium copper to use for a spring must be determined by the tool designer or toolmaker for each specific job. Type of application, material to be used in the tool, and amount of spring pressure needed are all determining factors, and must be considered before designing a flat spring of specific size.



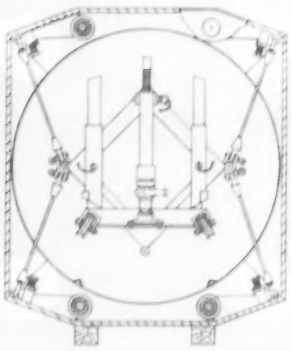
SPRING-LOADED STOP PIN or stock guide pin for a compound die is actuated by a flat spring. This type of construction eliminates the problem of drilling a clearance hole in the upper die block. In most cases this hole would be close enough to the die opening to weaken the cutting edge



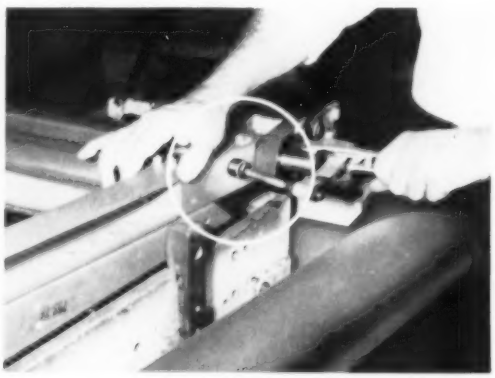
A STOCK PUSHER for a progressive die with a channel-type stripper is loaded by means of a flat spring. The spring is completely inclosed between the stripper plate and the nest pad or die block. This type is most effective for light-gage material where not too much pressure is required to align the stock. In the case of 1/32-in. material, or less, the slot for the pusher bar should extend below the stock level as shown in the cross section

TOOLING IDEAS your shop can use!

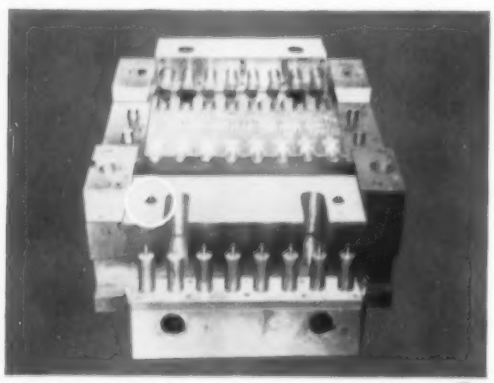
Shown below are just a few of the many uses for Vlier tooling accessories. Although these standard accessories are primarily used in jigs and fixtures, many companies are using them to replace custom-made devices in original equipment.



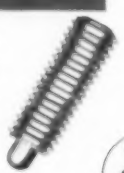
SPECIAL SWIVEL-PAD CLAMPS for a missile container manufacturer incorporate the remarkable Vlier ball-joint construction. Eight Swivel-Pad Clamps are used to release tension on cables which suspend the missile in its shipping container. This particular model withstands 21,000 load pounds.



CLAMPING PARTS WITH OFF-ANGLE SURFACES is no problem when Vlier Toggle Pads are used with a toggle clamp as shown here. The pad swivels 10° each side of the center line, assuring solid clamping of the part with no damage to the surface.



THIS 16-CAVITY, SIDE-ACTION PLASTIC MOLD uses four Vlier S-66 Spring Plungers as *detents* to lock the side-action bar in its travel to the center of the mold, eliminating costly, custom-made detents formerly used.



A glance at the new 1956 Vlier catalog will probably suggest many applications in your shop where you can standardize on Vlier accessories. Write for your free copy today.

New Head Design

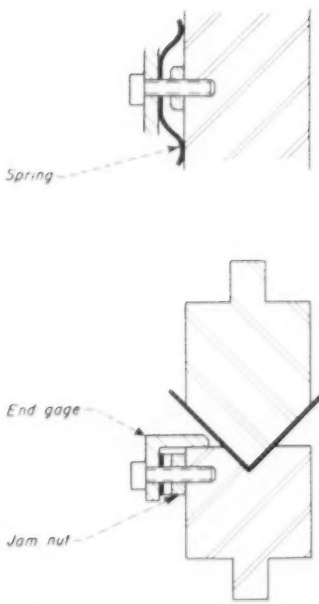
on all Vlier Torque Thumb Screws protects working parts from dirt, chips, and other foreign matter. Truarc ring makes disassembly easy. In all Vlier Torque Thumb Screws the ball-check is perpendicular to the screw axis, preventing uneven wear and wobble.

VLIER ENGINEERING INCORPORATED

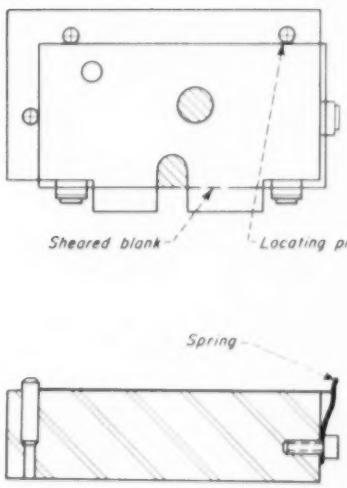
8900 Santa Monica Blvd., Los Angeles 64, California

Insist on Vlier Tooling Accessories... there's still no substitute for quality

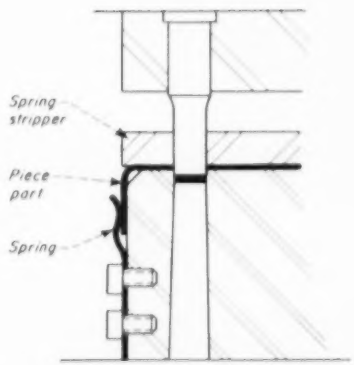
Flat Springs Improve Tools . . II



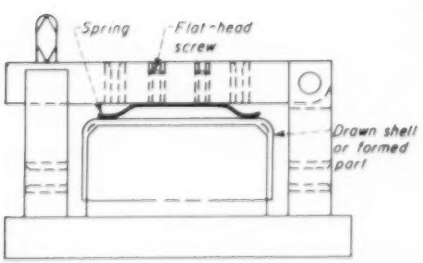
AN ADJUSTABLE END GAGE for a press-brake die is positioned by one or more socket-head screws with flat spring backers



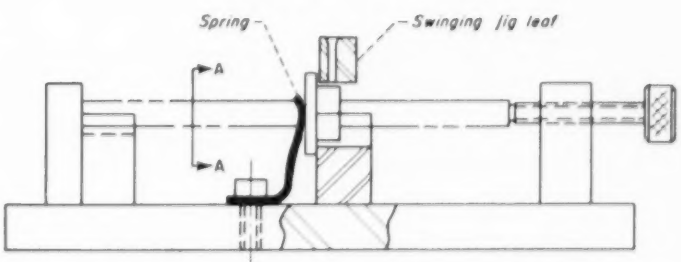
IN A PIERCE AND NOTCH DIE for a sheared blank, where the piece-part must be placed against locating pins on two sides, two or more simple flat spring pushers assure the operator that the part is in place



A FLAT-SPRING PUSHER is used on a typical horn die that pierces or notches a part with one or more right-angle bends. This type of spring could also be used to position a drawn or extruded shell of irregular shape, which is to be located from two sides



BUILT INTO A JIG LEAF, a flat spring acts as a hold-down device for drilling a part that is difficult to clamp. Clearance holes for the drills can be drilled right through the spring, with no fear of chips causing a malfunction of the hold down

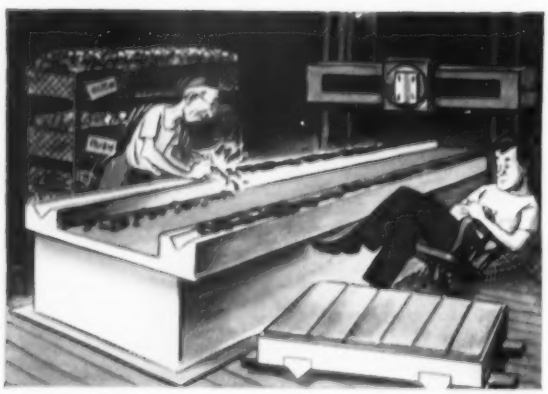


SPRING PUSHER POSITIONS a gear or other detail on a round shaft in relation to another part of the shaft for drilling and pinning. Ease of loading is of prime importance in this type of jig. A spring positioner is superor here to most manual clamping devices

1. Cures "stick-slip" or "jumpy table". When a table gets the "shakes", especially after it has just reversed or when the load is heavy and the speed slow, it's probably suffering from "stick-slip". Remedy—Sunoco Way Lubricant®. Special polar compounds in Sunoco Way Lubricant form a friction-reducing film that keeps a table sliding smoothly under all operating conditions.

2. Doesn't squeeze out. When you use a heavy oil as a way lubricant, you must use a lot of oil to maintain a thick enough film. But, heavy oil squeezes out if the table sits in one position very long. You have a tough time getting the table moving again. Protected by the tenacious thin film formed by Sunoco Way Lubricant, the machine can be idle for a week and it will start easily.

WHY SUNOCO WAY LUBRICANT CAN HELP CURE YOUR MACHINING PROBLEMS



3. Protects expensive ways. Badly scored or pitted ways, caused by inadequate way lubrication, result in lost production and expensive repairs. The high film strength of Sunoco Way Lubricant eliminates the danger of metal-to-metal contact, the chief cause of scoring and way wear. Excellent metal-wetting and non-corrosive properties eliminate rusting and pitting.

For the lubrication of slides and ways on this machine, we recommend the use of
SUNOCO WAY LUBRICANT
a product of
SUN OIL COMPANY

4. Approved by more than 55 machine-tool builders. Every major machine-tool builder has tested Sunoco Way Lubricant. It is always approved. In fact, to assure maximum efficiency of their product, many manufacturers ship a supply of Sunoco Way Lubricant with each machine. We'll be glad to send you the list of manufacturers who have approved Sunoco Way Lubricant.

For more information, see your Sun Representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-7

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American Machinist

INVESTMENT-CAST ALLOYS

New material specifications have been released by the Investment Casting Institute, Chicago. The data are the result of several years research and study by the Institute's Metal Specifications Committee to formulate specifications compatible to both user and producer requirements. One of the problems often encountered is that investment castings may be re-designed from stampings, forgings or machined parts, and, in the absence of specific investment - casting specifications, are sometimes specified to wrought metal specifications by the purchaser.

Because metal specifications contain control data peculiar to a particular method of fabrication, it is unwise to expect wrought specifications always to be satisfactory for investment castings.

In addition to the specifications abstracted for steels and non-ferrous materials, the Committee developed specifications for cobalt-base and nickel-base super alloys, working from familiar aeronautical material specifications covering these alloys.

Physical Properties

Material Code No.	Condition	Tensile Strength, Psi	Yield Strength, Psi	Elongation in 4 D, %
		CARBON STEELS		
I. C. 01020	Annealed	60,000	40,000	35
I. C. 01040	Quenched & Tempered	100,000	90,000	10
		LOW-ALLOY STEELS		
I. C. 04130	"	120-160,000	110-130,000	10.0
I. C. 04140	"	130-160,000	110-140,000	8.
I. C. 08730T	"	135-170,000	115-150,000	8.
		ALUMINUM ALLOYS		
I. C. 20356	T-51	23,000	16,000	—
I. C. 20356	T-6	30,000	20,000	3
I. C. 20356	T-7	30,000	—	—
I. C. 20355	T-5	25,000	—	—
I. C. 20355	T-6	32,000	20,000	2
		MAGNESIUM ALLOYS		
I. C. 21455	F	20,000	Not required	
I. C. 21455	T-4	34,000	Not required	
I. C. 21455	T-5	20,000	11,000	
I. C. 21455	T-6	34,000	18,000	
		SILICON BRASS		
I. C. 10525		60,000	26,000	16

Compositions of Non-Ferrous Alloys

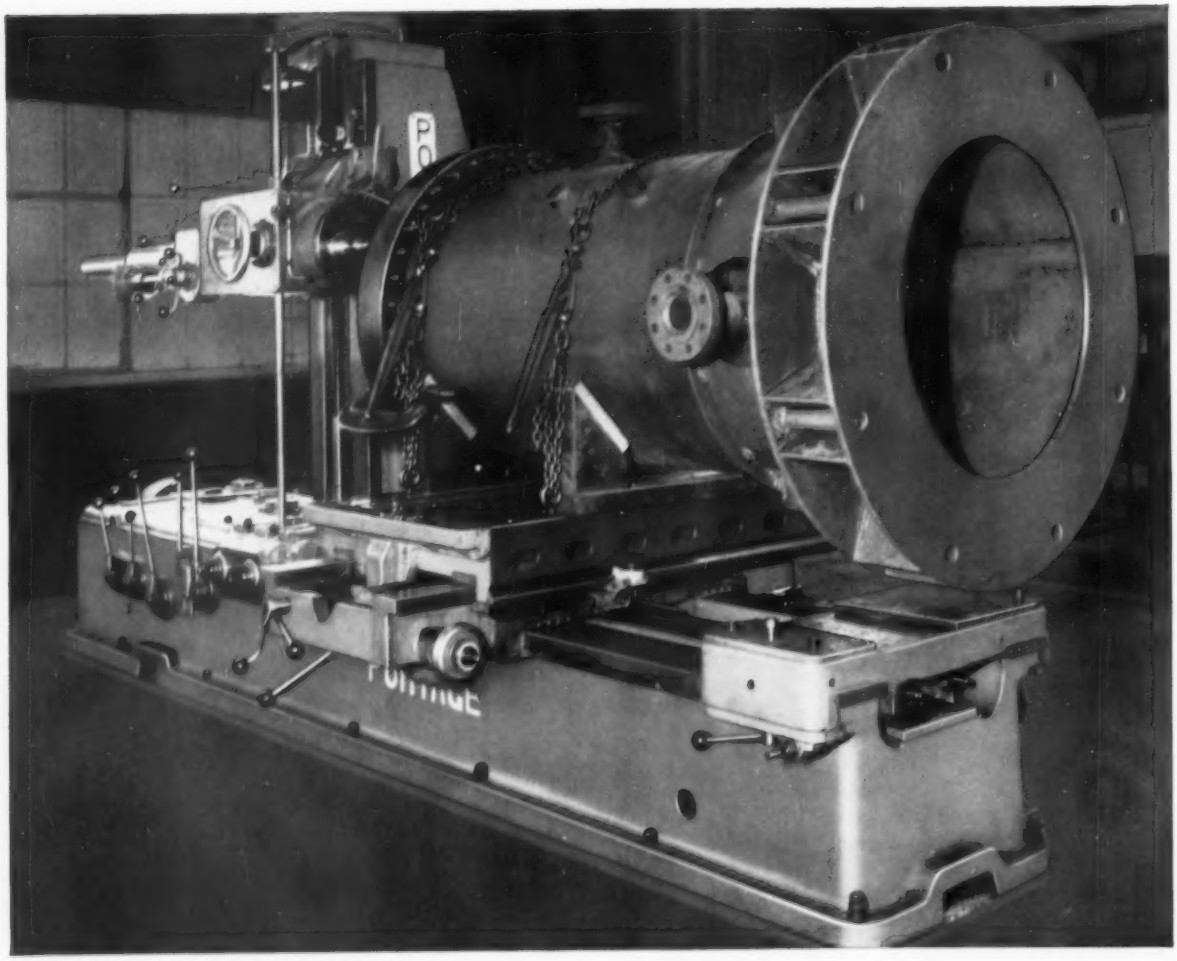
Grade I. C. Code No.	Aluminum Alloys Sil-Mg 20356	Aluminum Alloys Sil-Cu 20355	Magnesium Base Alum-Zinc 21455	Silicon Brass 10525
Aluminum	Balance	Balance	8.3-9.7	0.1 max
Copper	0.2 max	1.0-1.5	0.25 max	Balance
Iron	0.6 max	0.6 max	—	0.5 max
Silicon	6.5-7.5	4.5-5.5	0.3 max	3-5
Manganese	0.3 max	0.3 max	0.10 max	—
Zinc	0.3 max	0.2 max	1.6-2.4	10-16
Magnesium	0.2-0.4	0.4-0.6	Balance	—
Chromium	—	Note 1	—	—
Titanium	0.2 max	0.2 max	—	—
Nickel	—	—	0.01 max	—
Lead	—	—	—	0.5 max
Phosphorus	—	—	—	0.03 max

Note 1—Chromium 0.20 max, but chromium plus titanium may range from 0.08 to 0.30

Compositions of Investment-Cast Steels

Grade I. C. Code No.	Low-Carbon 1020	Med. Carbon 1040	Chrome-Moly 4130	Chrome-Moly 4140	Ni-Chr-Moly 8730T
Carbon	0.15-0.25	0.35-0.45	0.25-0.35	0.35-0.45	0.25-0.35
Manganese	0.30-0.60	0.70-1.00	0.40-0.70	0.70-1.05	0.60-0.95
Silicon	0.20-1.00	0.20-1.00	0.20-0.80	0.20-0.80	0.20-0.80
Chromium	—	—	0.80-1.10	0.80-1.15	0.35-0.65
Nickel	—	—	—	—	0.35-0.75
Molybdenum	—	—	0.15-0.25	0.15-0.25	0.15-0.30

Phosphorus and sulfur—0.04 max. each; unspecified elements, 1.00% max



Photograph courtesy of Western Supply Company, Tulsa, Oklahoma

Read what this man has to say about PORTAGE MILLS!

Mr. D. W. Brady, Plant Manager of Western Supply Company, Tulsa, Oklahoma says,

"Our manufacturing facilities here at Western are devoted almost entirely to heat exchanger production. We have found the versatility of the Portage Mills allows us to do a wide variety of machining operations required in the fabrication of this type of work. We have found the machine to be very reliable and have experienced no lost time for repairs since it was installed."

Mr. Brady's kind remarks are typical of those coming in from across the country . . . PORTAGE MILLS are truly the *machine of the year* . . . and remember . . . Portage costs less to buy. Write for the illustrated catalog . . . and ask for a proposal too!

THE Portage MACHINE CO.

1026 Sweitzer Avenue • Akron 11, Ohio

Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

Talking Shop . . .

Strong Point

NEW MATERIALS, sometimes tailored to measure; new processes, based on the new materials; new tooling, based on the processes—this is the course of recent development. And it all is built on communications—the conveying of ideas from one man to another, principally by the printed word. In this Atomic Age, the pen is truly mightier than the sword.

Checker-Up

DIESEL-ELECTRIC locomotives built in Czechoslovakia are equipped with an electric signal that operates every 90 seconds. Unless the engineer responds to each signal within 6 sec, an audible signal is sounded and, unless the engineer cancels this within 4 sec, high-speed brakes are applied automatically and the main circuit-breaker is tripped.

What's Cooking?

BOEING has installed a 9-ft-dia x 27-ft-long autoclave at Seattle for metal bonding. This is the company's third, the first two being at Wichita (installed in '54 and '55). All are company-designed and built. The new unit contains three platens, permits three "tables" to be loaded while three others are "cooking." It avoids the necessity of elaborate setup with vacuum diaphragms, gives 10 times the pressure if desired (150 psi at 350 F). Bonding is used on wing trailing edges and similar parts to replace rivets or bolts, gives a better joint of lower weight and better sonic characteristics—important in a jet. It utilizes plastic-base adhesives set by heating above 300 F.

Budd Cadets

TEN YEARS AGO, the Budd Co, Philadelphia, set up a cadet course to train college grads for management. Ex-cadet A (35) is now one of 12 men on the staff of Edward G Budd, ex-cadet B (35) is asst supt of a large production unit, ex-cadet C (31) is plant controller. The course is two years, ends in an assistant foremanship at $110 a week. From there on, it's up to the man. There has been wide variety in advancement, but some men have won through, as shown above.

Raises at the Middle

THREE OF FOUR "middle-management" men (first-line supervisor up to policy-making level) received raises last year, reports the AMA. Among some 20,000 men at this level, average pay was $11,347, up 5% over the previous year. Raises were 5 to 9% in 35% of the cases, and 47.8% received bonuses—about the same as top management. Some 7.5% changed jobs. Most of the men are 35 to 49 years old, and those in manufacturing and sales make more than those in engineering, finance, or personnel.

Bootstrapping

SOME 87 special mechanical units have been designed and built by Lewyt Corporation, L I City, NY, in its own automation program. One of the newest is a reaming machine for trimming aluminum elbows for the vacuum-cleaner floor nozzle. It is a double machine, fed by one man, that produces 300 pph—three times the old production. Inside and edges of the piece are reamed, and a hole for a clip is drilled at the same time.

Goodbye, Hotbox

ALLISON DIV of GM just announced a cartridge-type, sealed axle bearing for railway cars. It includes a hardened axle sleeve, an aluminum-alloy bearing, felt-wick lubricator system and an oil-seal assembly, all in a housing that fits into the standard journal box. The bearing is of the sleeve type, running on a hardened journal sleeve, avoiding lift or shift and reducing wear. Such a bearing is suggested by recent European success with sleeve bearings on locomotives making record runs.

Another Biggest

CURRENTLY largest among butt-welders has just been delivered by Siemens Schuckert to another German company for welding rail crossovers and base plates for siding joints. It is a 150-ton unit, capable of exerting 120 tons compression hydraulically and delivering 100,000 amp. Largest section that can be welded is 40,000 sq mm (about 62 sq in.), and the machine is 26 x 10 ft x 20 ft high.

Same Time Off

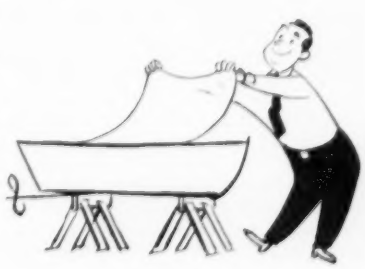
CLEVELAND Chamber of Commerce reports that 273 of 336 plants will close for employe vacations this summer. Of them, 148 are closed currently (first two weeks in July). Only 93 plants will have staggered vacations.

New Wonder

MOLYBDENUM is the newest candidate as a "wonder metal," says Dr J Herbert Hollomon of GE. But it won't be a solo performance—moly must be protected from oxygen when heated, or it goes up in smoke. His staff is working on coatings to protect it, as well as on non-brittle ceramics for use beyond 2500 F, and on stronger metals in general. Thus far, copper crystals have been produced with tensile strengths 20 times normal, other metals with similar increases—but only in very small, and very costly, quantities.

Ships on the Line

A CZECHOSLOVAK SHIPYARD is now building river steamers up to 330 ft long on a progressive assembly line. The ship is erected in a special cradle that carries it from station to station, and finally to the electrically operated launching position for sideways launch. All erection is done indoors, so there are no delays on account of weather.



News of Metalworking . . .

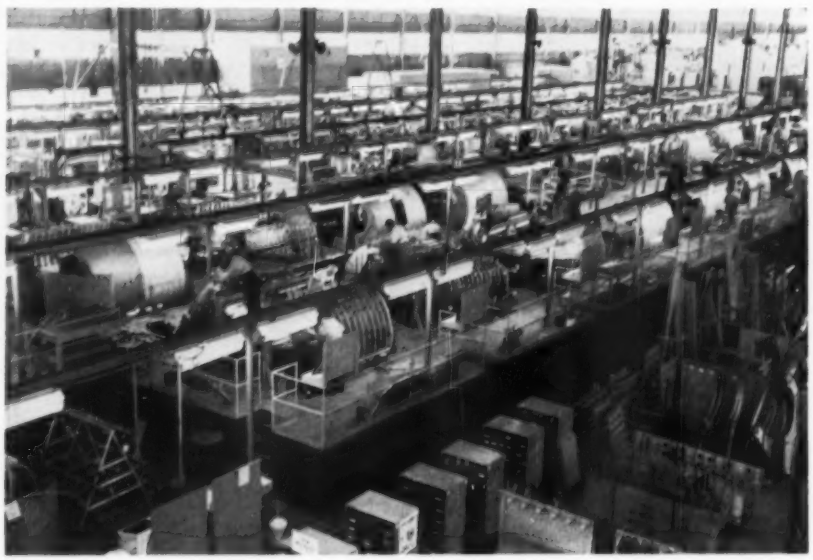
"Deadliest air-combat weapon" . . .

Convair's F-102A delta-wing all-weather jet interceptor carries both Falcon air-to-air guided missiles and 2-in. folding-fin rockets. Falcons are carried in missile bays on the underside of the fuselage, can hunt down an enemy bomber several miles away. Rockets are stowed in firing channels built into rapid-acting missile-bay doors. The plane, now in full production, becomes operational this year with Air Defense Command squadrons.

During the 5-year development cycle, Hughes Aircraft Co has been working on a compatible weapon system with "high synthetic IQ . . . to free the pilot for the exercise of judgment." The system for the F-86 and F-94 had 2000 parts, that for the new F-89H has 5000. The system for the F-102A (exclusive of missile) has 7000 parts and provision for more. It weighs 1700 lb, occupies 28 cu ft. Incorporated is a narrow conical-beam radar which searches for the target. When the pilot sees the target on the radar scope, he locks the radar onto it, and the radar thereafter automatically tracks, giving the pilot instructions to put the interceptor on a straight-line track for missile launching. The system also prepares missiles, launches them, and guides them to the target at the proper time.

Obviously, the plane can fly at supersonic speeds and stratospheric altitudes. It has a single-place "Coke-bottle" (Area Rule-waisted) fuselage, 68¼ ft long, with a 38-ft wing carrying the fuel for a Pratt & Whitney J-57 turbojet with afterburner. The delta wing is economical to manufacture, gives plenty of fuel storage without external tanks, provides low landing speed and freedom from stalling, yet gives a very stable platform. A more-powerful version, incorporating the J-75 engine, will be "phased in" later this year.

Line Assembly Turns



In-line stocking saves time and steps . . .

Components, fasteners and other materials are stocked (foreground) adjacent to areas where quarter sections of fuselage are assembled. Parts are identified by 3-digit (!) number: workmen get their own instead of drawing them by lots from a central stockroom

SAN DIEGO, CALIF—Volume production was planned from the start on the F-102A supersonic all-weather jet interceptor built by Convair Division, General Dynamics Corp, here. Thus, production designing and engineering were involved from the beginning, as well as permanent production tools and detail drawings, according to A P Higgins, works manager of Plant II. This plant was empty in January, 1953—it had been used to build B-24 parts in World War II—when the task force moved in. In April, 1954, the first production plane was delivered, just 16 mo after the program began.

Production rate was held relatively low during an 18- to 24-mo test program, but "hard" tooling was used from the beginning, so rapid acceleration was possible at any time. Machine tools and other equipment were supplied by the Air Force to handle accelerated production if required. This is in accord with the Cook-Craigie Procurement Plan. Some parts are made in San Diego main Plant I, others at Fort Worth, Pomona, or by subcontractors. Convair was the first user of parts forged under the Air Force heavy-press program.

Accessibility is the feature in assembly. Instead of building the airframe, then installing equipment, Convair has set up 89 assembly stations at which subassembled components of manageable size are built in, as in automotive practice. This is based on a study of subassembly times and a master schedule and sequence chart.

Optical Alignment

Fixtures are aligned with optical instruments, and many are trunnioned for accessibility. One of the first components in assembly is the ram-air duct, a heavy skin over ribs. Workers on both sides assemble it. It goes to cockpit assembly, where sidewall panels, front and rear bulkheads and floor are built up in a fixture. To them are attached ram-air ducts and cockpit windshield frame.

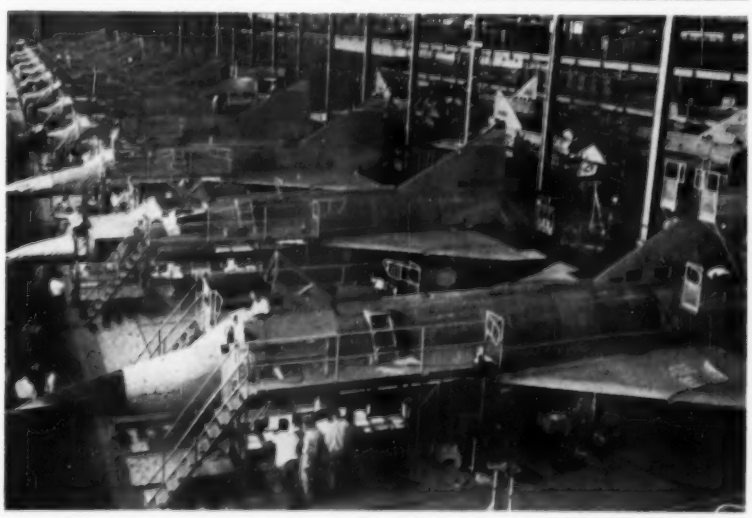
The assembly goes to a trunnioned horizontal fixture on a moving assembly line. Panels, instruments, tubing and wiring are added at various stations. The finished cockpit goes to another fixture for joining

Out F-102A Interceptor in Quantity

Delta-wing sections go along a line . . .
Basic wings move forward on the center rail structure, while elevons, control mechanisms, landing gear and doors, wiring and tubing are added. Again, materials and parts are in nearby bins

Coming next issue!

The best series of full-color photographs we've ever seen—29 of them—will show how titanium shrouds for F-102A's J-57 engines are made. Watch for it—in July 16 AM



Near the end of the main line . . .
Needle-pointed radomes are added and final checkups of control and pressure-tightness are made here, at the end of the assembly line. This is soon to be mechanized so assemblies will move steadily to the end

with the nose section (for electronic equipment), and the assembly to the fuselage-mating area.

Fuselages are made in quarter sections, right and left, fore and aft.

Ribs are set up on the fixture, and inner and outer skins added, then the quarters assembled into the center barrel in a mating fixture (see photo). The aft barrel, which houses turbojet and landing wheels and supports the vertical fin, is assembled in two major parts. Fin and side panels are put together in one setup, the forward portion is formed around heavy forged bulkheads in the other.

A huge fixture holds the center barrel while forward and aft sections are brought to it and tied in, then the fuselage goes to the primary assembly line for primary installations and mating with wings.

Wings Also Fuel Tanks

Wings are made in two tank sections. Upper and lower surface wing skins are drilled and counterbored on a special machine, then riveted to ribs and spars with an adhesive sealant between faying surfaces. Rivets are the Straylor type, with a centered recess in the head which must show after facing to indicate sufficient head strength remains. Tank sections are oven-baked at 320 F to bond the adhesive and make tanks tight, then put on a trunnioned fixture so gasketed access doors can be added and wing tanks tested for leaks at 7½ psi. A vertical fixture handles mating with the aft wing tank and trailing-edge assemblies. Assembled wings go to a vertical trim and bore "fixture," in which a tool buggy on an incline mills the leading-edge spar to the proper trim line, routs the periphery of the main landing-gear opening, precision-bores and reams landing-gear attach holes. Another machine bores spar-attach holes to exact size, then the wing goes to the primary-assembly line (see photo). Wiring passes through fuel tanks, but has only normal insulation because of low currents. Completed wings go to the fuselage-mate area where they are on an adjustable dolly.

The structurally complete plane now goes to final assembly for engine, canopy glass, and checkouts of systems and controls (see photo).

News of Metalworking . . .

"Bromo-Seltzer" packaging . . .
For the manufacturer who uses bearings only as the occasion arises, rather than in continuous manufacture, MPB furnishes bearings coated with rust preventive hermetically sealed into long plastic strips, with each bearing-containing segment identified. When manufacturer needs a bearing he cuts it off with an ordinary scissors

Small Stuff Is Big Business

KEENE, N H—How's this for a plant manager's dream? The postman carries in your entire supply of bar stock for a month in one hand —walks out carrying your entire day's output in the other. Chip disposal? Just toss 'em into the wastebasket, and at the end of a week you haven't even filled it. Shipping? You ship everything by air because the cost differential between that and regular freight is only a matter of pennies. Top that off with a beautiful location in the heart of New Hampshire's vacationland, and you have an A-1 attraction for personnel.

That in a nutshell describes the newly opened plant of Miniature Precision Bearings Inc here.

MPB is capable of designing and manufacturing miniature (from 0.078 to 0.375 in. OD) precision ball bearings to your specifications in quantities of dozens, or of thousands—in 500 standard sizes and types, too.

From the time the postman delivers the bar stock, here's how MPB's new $750,000, 50,000-sq-ft plant operates. The bar stock is stored in one of three 4 x 4 in. racks, each of which holds an entire month's supply of steel and beryllium copper. Bar is then fed into one of 10 or so Brown & Sharpe 00G automatics that turn and drill the inner and outer races, leaving a minimum cut-off burr and stock removal for subsequent operations. Average surface finish is 30 mu in rms.

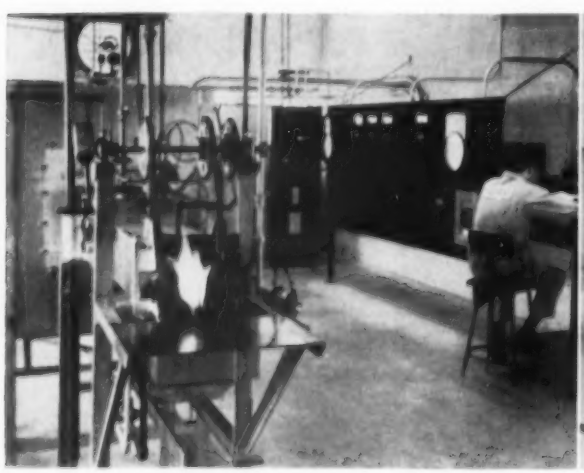
Air Change Every 2 Min

Bearing races then go into heat treating area (see photo below), which is equipped with blowers that provide a complete air change every 2 minutes. Next, they are tumbled and lapped to a tolerance of 0.0007 in. on the width, and 0.0001 in. parallelism to provide accurate nesting in subsequent operations.

Bearing races are then finish-ground and sized.

From grinding, the bearing races go into the in-process inspection area, where they undergo statistical sampling. Accepted lots of races and balls (made elsewhere but refined by MPB) move into a controlled environment assembly area, where they are matched and stored. When needed, they are washed, assembled, rewashed, graded dimensionally, tumbled in special solutions and mixtures for further refinement, washed a third time, performance tested, and washed for the fourth time.

Bearings are packaged either in small sealed vials filled with an excess of lubricant, or individually between sealed plastic strips (see photo above). In packaging, the completed bearings are washed again, lubricated to specification, and packed—all mechanically.



Everything at MPB is small-scale—from heat treating to packaging—except its million-bearings-a-year output

CONTROLLED NITROGEN-ATMOSPHERE FURNACE hardens ring blanks from the automatic turning department before they are tumbled and lapped

SPECIAL LINT-FREE CLOTHING, cap to prevent loose hair, are worn by workers who pack miniature bearings in plastic vials in controlled-environment room

Shipbuilding Makes a Comeback

WASHINGTON—U S shipyards are snapping back to prosperity after going through a long period of near shutdown. Now, they see ahead one of the best years since the plush days of World War II. Behind it all lie government programs coupled with the current high demand for ship tonnage.

$1-Billion-Plus New Business

Right now, shipyards around the country are working on $400 million worth of new merchant ship construction or major conversions: some 52 ocean going ships are involved.

Congress recently approved $82.7-million dollars to cover the government's share of new ship construction for fiscal 1957. This is estimated to send another $150 million worth of work to the yards. On top of this comes the big $1 billion Navy Shipbuilding Program for national defense.

More to Come, Too

In the works, too, are programs that will keep yards humming if all goes as planned. They include agreements between the Maritime Administration and private shipping companies to replace present outdated ships with new ones over the next 20 years. Such companies as American President Lines, Grace Line, Moore-McCormack, and others have agreed to build over $1 billion worth of new ships in U S yards over the next 20 years. Block obsolescence of the present US merchant marine is expected to push this figure even higher, with the peak coming in the 1960's.

Roll-on-roll-off Ships

More immediate prospects for shipyards are construction of new roll-on-roll-off ships to haul loaded truck trailers in the coastal trade. McLean Industries Inc plans to place contracts for seven of these ships in the next month or so, to cost $73 million. Other companies are talking similar construction.

Congress is looking favorably on legislation that would throw open some 18 to 20 government reserve fleet tankers for charter in domestic trade on conditions that one new tanker be built for every two chartered. It could mean up to $80 to $90 million more in shipyard contracts.

Other shipbuilding is being talked too, such as replacement of over-age bulk ore carriers on the great lakes; and building special ships to carry coal to overseas markets.

It all adds up to a rosy outlook for shipyards, but the industry knows from experience that it isn't safe to count new ship construction until contracts actually go to the yards. Nonetheless, prospects for the long-suffering shipyards are better than they have been for years.

Lead Additions Best at High Speeds

Sulfur at Low, MIT Study Shows

CLEVELAND—With the aid of high-speed flash pictures of chips in the process of formation, it has been found that the addition of lead to steel is effective in decreasing chip thickness at all speeds, but particularly at high speeds. Studies of lead and sulfur additions were reported at the ASME Summer Meeting by Prof M C Shaw, P A Smith, and N H Cook, all of Mass Institute of Technology, and E G Loewen of Taft-Peirce Mfg Co.

Sulfur, on the other hand, was found most effective at speeds that resulted in tool temperatures below 900 F. Some cutting fluids (principally cutting oils) interfere with the action of lead and sulfur. Fluids that are normally effective on ordinary steels may give poorer results than air with steels containing lead or sulfur.

Effect of Rake Angles

HSS tools with different rake angles were checked on leaded and unleaded steels. For unleaded steels the optimum rake was 5° at 200 sfpm and 15° at 350 sfpm. The leaded steels are much less sensitive to changes in rake angle, but appear to have about the same optimums. One thing the tests did show was that there is no justification for specifying a rake angle to closer than the nearest 5°.

HSS Grades Compared

In comparisons of two HSS grades, the M-2 tool gave better results in terms of friction force and tool temperature at 200 sfpm, but the T-15 tool performed better at 300 sfpm. Better performance of M-2 at 200 sfpm might be attributed to better thermal conductivity, and its worse performance at 300 sfpm to softening at elevated temperatures.

Feed rate was found to have a large influence on leaded steels, the greatest improvement from leading being found at the highest feed rates.

Cutting fluid has an effect on friction force only up to about 150 sfpm, while the influence of lead (internal lubrication) is effective at all speeds. Tool temperature is reduced by cutting oil up to perhaps 500 sfpm, and to even higher speeds with water-base fluids. On the other hand, there appears to be no limit to the speed at which lead is effective in reducing tool temperature.

Cutting Fluid Is Critical

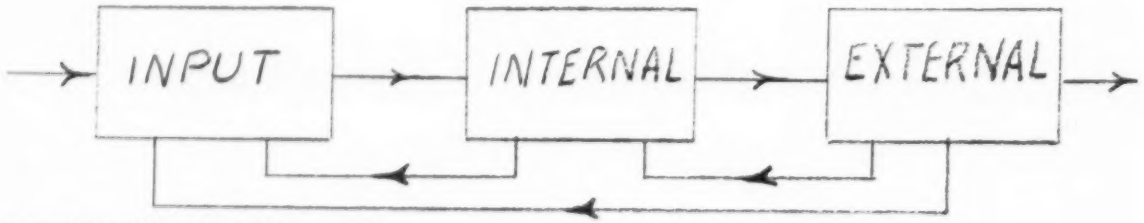
Some cutting oils have a detrimental effect on tool friction, tending to prevent the lead from spreading and acting as a lubricant. Thus when a cutting fluid is used with a steel with free-machining additives it is important that the two be compatible.

Effect of lead in AISI 4140 alloy steel was found to be essentially the same as in the screw stocks. As before, the effect of lead was more pronounced at higher feeds and speeds, while the effect of sulfur was best at low speeds and feeds.

Carbide Result Comparable

Carbide tools were found to give the same results as HSS with one exception. Because of the different friction characteristics, carbide gave higher friction than HSS at low speeds. Above about 100 sfpm, it is less than with HSS.

The test results cannot be translated directly into tool-life predictions because of the influence of the built-up edge. The factors considered do influence finish and the matter of tool life is a question for future research.



Interrelationship of machine control . . .

All machine control consists of three interrelated elements: input (the operator in the simplest system), internal (transmission, headstock, dials, stops, etc), and external (inspection dept). Note how elements are coupled by feedback (lower arrows), so corrections can be made. When control becomes automatic, the first element, then the third, becomes automatic; there is no basic system change—*Smith*

From ceramic tooling to ultrasonic cutting . . .

New Wrinkles Turn Up at Cornell

ITHACA, NY—Many new and startling developments in Metalworking were described here at a group of industrial engineering seminars at Cornell University June 12-15. Typical of the burgeoning series of such "refresher courses" at major engineering colleges during each summer, this one included ideas not previously published. Examples:

Sparkplugging Ideas

AC Spark Plug Div, GM, has been using a test for creativity for the past three years that picks out men of exceptional creative ability in any department. H L Roat, director of Production Engrg there, said that creative ability can be stimulated in an organization—providing there is a "sparkplug" at the head of it. A campaign for creativity cannot be sold *up*; it must be sold *down* from the top. Last year, AC had 355 successful projects as a result of its creativity campaign, and they paid the cost of the "annual improvement factor" (6¢/hr).

Projects are evaluated by teams consisting of a production engineer (head, and a man interested in the general area of the idea), methods engineer, process engineer and tool engineer. Some ten such teams have been formed, and handle not only the creative idea, but also follow it into normal operation and correction of troubles. Projects are initially classified in the "C" group; if they show potential in evaluation, they go to the "B" group if concerned with the product, the "A" group if concerned with the process. At this point management becomes directly interested, and the project is "brainstormed" to determine all solutions. There are usually several successful solutions; the real job is to find the best. For example, in one case, the team and Mr Roat plus another member of management, "brainstormed" 49 ideas, selected 16 from these after a week of individual thinking about it, finally settled on the four best to be tested. This was a product idea—dealing with pressurization in the cooling system of a car—and resulted ultimately in a demonstration device for service men to show when a pressure-type radiator cap should be changed.

Mr Roat showed two case studies in creativity, one an automated assembly setup for sparkplugs, the other a line for making the oil-filter body. The latter includes blanking, drawing, machining, painting and welding, most of them fully automatic. An incidental feature of interest is test of a circular oxide bit for deburring the end of the pressed "can." Indications thus far are very good.

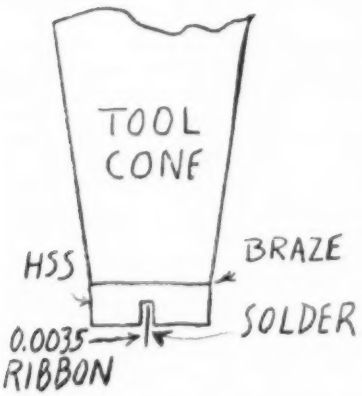
Latest in Ceramics

Latest developments in ceramic tooling were listed by E J Tangerman, executive editor of AM, at another session. He listed results of a number of manufacturing tests and indicated some of the current conflicts in data because the material is so new. For example, one company finds 800 fpm better than higher speeds with ceramics, another finds 1200 and up preferable. One company reports bits from a particular supplier better than those from another—not knowing that one company makes both, the difference being only trade name. On two automotive finishing operations, parts per tool grind were doubled by shifting to oxides, and finish was improved.

Larger work seems to have greater stability, hence is cut easier with oxides. In one such case, a number of bits averaged 20,000 ft of chip on a 3½-in.-dia workpiece, two bits got up to 70,000 ft, and at speeds much higher than with carbides. Another study reports that oxide cutting edges wear rapidly from abrasion at speeds under 600 fpm (on AISI 1020). In another case SAE 6150 was cut at speeds from 540 to 1800 fpm. The bit failed quickly dry, but lasted well when misted with wax coolant.

Several companies have successfully brazed bits to shanks, and one new supplier (Raybestos-Manhattan) is now offering single-point and form tools of this type. One automotive company has attached ceramic bits to shanks with Cycleweld and Devcon adhesives, believes these will work because of the low heat conductivity of oxides.

A transmission maker, buying 150 new machine tools, is getting heavier, more-rigid units in anticipation of oxide cutting. Another plant in the same city can't even test oxides because its machines were bought on an "economy" basis and do not have enough power. One auto maker is ordering a higher-powered machine to give an adequate test, a tool builder is buying a test lathe with built-in dynamometers. A tool builder reports a "grinding" finish on 4150 at 1900 sfpm, with ¼-in. cut and 0.015-in. feed. Another reports very en-



Ultrasonic slot cutting. . .

Very thin slots can be cut by ultrasonic means with this method. A slot cut with a slitting saw in a steel block brazed to the tool cone carries a brass ribbon as the tool. The ribbon is soldered in so it can be changed quickly when it wears. It never projects so much that rigidity is lost. This setup cuts a slot 0.004 in. wide—*Moschella*

couraging tests on cast iron, with a 30° angle instead of the usual 1/16-in. radius on the tip. A printing-press builder will use oxides on a 15-in. diameter, carbides on a 4-in. simultaneously in a new lathe. A grader maker takes off 1000 cu in. per grind with oxide bits, makes one cut over 6 ft long in 11 min instead of the previous 41.

System, Not Tool

The machine-tool builder developing a design to handle a production operation now finds himself designing a system rather than a machine tool, according to David N Smith, manager of Research & Development, Jones & Lamson Machine Co. He must consider controls and work handling, frequently automatic handling. Feedback is an increasingly common concept. While the basic principles are the same: correlation of input (the data fed in by the operator), internal control, and external control (inspection), the first and third may now be automatic and integral with the machine, so there is no operator and no post-machine inspection. Feedback couples elements.

Recent experience with automatic machines has emphasized several points: (1) Three-quarters of Metalworking is concerned with lots of fewer than 25 pieces, so any machines designed for broad application must have great flexibility and be fast and easy to change over. (2) "Float" is essential between units in a line, a storage of enough work between machines to permit one unit to be shut down for a tooling change without disrupting a line. (3) Provision for maintenance is essential. This not only involves convenience and accessibility, but also ease of rapid replacement of such complex elements as controls, provision of spare parts where replacement is likely. (4) Coupled units will be shut down unexpectedly—tool breakage, control-relay failure, and the like—so it is advisable not to have too many units tied together. For example, five units, each with 95% availability, have when tied together only 79% availability (0.95^5). Latest trends are towards a maximum of three units tied together, with "float" between.

In answer to a question about the possibility of highly automatic small machine tools, Mr Smith pointed out that the possibilities are less attractive here, because they require little effort to operate manually, motions are short and/or fast, and the mechanization is frequently not worth the cost or complexity.

Paper-Thin Slots

Slots only 0.004 in. wide, but ⅝ in. long and ¼ in. deep (through a part) have been produced successfully by ultrasonic cutting, according to Ralph Moschella, manager, Sonic Products, Raytheon Mfg Co. The trick is a special tool head (see sketch) with a section of brass ribbon 0.0035 in. thick held in a slot. The ribbon edge can project only a quarter inch or less or it will lose rigidity, and it wears rapidly. Because it is held in by soft solder (while the slotted block is brazed on the tool cone) it can be replaced easily, however, so a narrow section can be used initially, with a wider one as the slot deepens and provides side support. In the case cited, the slot was cut from two sides to avoid crumpling of the ribbon, the part being indexed 180° after being cut halfway through.

Variety of Tool Materials

Mr Moschella also pointed out that recent experience indicates that tools may be made of many materials, not only brass. Raytheon has used various steels and stainless—even hardened materials—for tools. Toughness without great hardness seems to be desirable. Steels like Ketos have worked well. Also, aluminum oxide and silicon carbide are now used as abrasives as well as boron carbide.

Is Common Point Angle for Drills All Wrong?

CLEVELAND—Although the most common point angle for drills is 118°, each metal has a different range of point angle that gives longest drill life. Drill life in cast iron is at a maximum with a point angle of 60° at high speeds and moderate feeds, and with a point angle of 80° at lower feeds and speeds.

This was one of the conclusions drawn from experiments in drill performance reported at the ASME Summer Meeting by Dr D F Galloway, director of research, Production Engineering Research Associates of Great Britain.

Optimum point angle for En 10 (a 0.55 C, 0.75 Ni steel) heat treated to 110,000-psi tensile was 90 to 100°. For annealed En 30B (a 4.25 nickel-chromium-molybdenum steel) the best point angle was 130°.

There is also an optimum value of relief angle, although the differences from material to material are less marked than those for point angle. For steel and cast iron, best range is 9 to 15°.

Drill life was increased nearly three times by reducing relative lip height for ⅝-in.-dia drills from 0.015 to 0.001 in.

Point thinning is often applied to lengthen drill life. Of the methods of point thinning investigated, the most effective was one in which metal is ground off part of the trailing edge to provide greater clearance near the corners of the chisel edge. However, point thinning was often found to increase oversize and roundness errors, probably because of the difficulty of preserving symmetry.

Jigs Should be Clamped

Jig bushings were investigated. Short bushings considerably reduced the runout of the drilled hole when the jig was fastened down and accurately aligned with the spindle axis. When the jig was free on the table so that work and jig were positioned by entering the drill into the bushing, the range of hole runout was almost as great as when no bushing was used. Under the same conditions, a long jig bushing gave smaller values of runout, but hole alignment was still not as good as with a short bushing accurately positioned and rigidly clamped.

Field Report USA:

East...

Around the East . . .

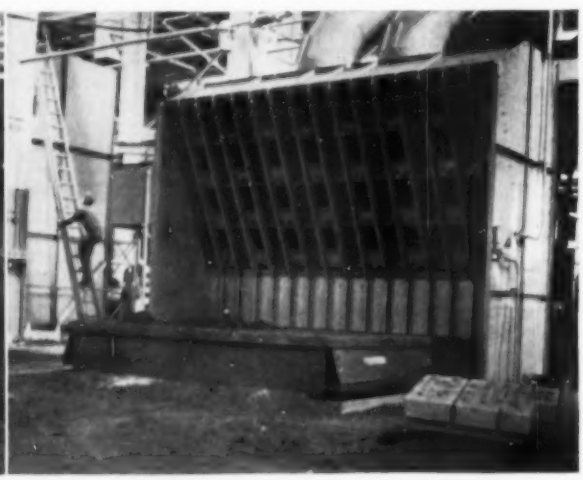
F J Stokes Machine Co, Philadelphia, has changed its name to **F J Stokes Corp.** Reason: the new name is more in keeping with Stokes' recent diversification into other fields . . . **U S Steel's American Steel & Wire Division** has set up at its Cuyahoga Works in Cleveland a laboratory devoted exclusively to fatigue testing. It's just one big torture chamber for springs, cables and other wire products . . . **Lofstrand Co,** Rockville, Md, recently acquired by **New York Wire Cloth Co,** will be developed as specialists in metal fabrication for government and industry . . . **Pittsburgh Screw & Bolt Corp** is holding merger negotiations with **Oliver Iron & Steel Corp.** Nothing definite as yet . . . An expansion program at **Delta Power Tool Division** of **Rockwell Mfg Co** will increase total manufacturing facilities of the division by 70% in the next year . . . **Delaware Valley** area will be the site of two multi-million dollar expansion programs. **U S Steel** plans to add to its Fairless Works and **Philadelphia Electric Co** intends to increase its capacity by 35% . . . **National Diamond Hone & Wheel Co** will close its NYC plant and move into a 5000-sq-ft plant in Peekskill, N Y . . . A 14,000 ton extrusion press will be installed by Alcoa at the company's Lafayette, Ind works. Structural shapes up to 110 ft in length and weighing as much as 2500 lbs will be produced on this press . . . **Wallace Barnes Steel,** Forestville, Conn, continues to expand. A new 16-inch Sendzimir cold-rolling mill, the largest of its kind in the spring industry, was recently placed in operation . . . **Morgan Aluminum Welding Rod Co,** manufacturer of aluminum and magnesium welding rods and electrodes, is moving its entire production operation from Cleveland to Mt Carmel, Pa. At least a 100% increase in output is expected . . . **All-American Engineering Co** has been awarded contracts totaling about $2 million by the Navy for research and development projects . . . The Dominican Republic has recently contracted with **Glenn L Martin Co** for construction of a nuclear-powered electrical generating system to meet the growing requirements of the island. Of moderate size, it is the first of the atoms-for-peace plants for export . . . April non-farm employment in the N Y metropolitan area declined from the March levels but still topped the year ago figure . . . Some 350 employees of the **R M Hollingshead Corp,** Camden, N J, returned to their jobs on June 4 after a week's strike

Bullard Opens $7-Million GI

BRIDGEPORT, CONN—Bullard Co's new $7-million gray iron foundry, the most modern and one of the largest in the East, is turning out up to 125 tons of finished castings per day here—primarily for Bullard's own use on its machine tools. Designed to produce today's machine tool castings, much larger than those of a few years ago, the new foundry's castings are limited in size only by existing crane capacity—currently 50 tons. Bullard is also producing castings on a contract basis to other users of heavy or thick-walled GI castings. Two cupolas are now on the line, and a third can be added if needed.

The 600 x 240 ft structure features working conditions equal to those found in the machine shop—because of dust control, one air change every 15 minutes, high-intensity lighting, and mechanization of all operations. Very little hand ramming of molds will be done. Inside storage of all materials in the new foundry, while expensive in foundry practice, is considered by Bullard to be essential to good working conditions.

Giant sandslinger . . .
fills molds at Bullard's new foundry at a rate of a ton-a-minute, freeing a skilled molder to direct the operation, apply finishing touches



Vibrating shakeout . . .
has large ventilating shakeout placed close to the casting washer, where high pressure jets are directed at all casting surfaces by moving spray head

brought on by a seniority dispute . . . **Reeves Instrument Corp,** a subsidiary of **Dynamics Corp of America,** is supplying the Air Force with new and improved radar systems under a $40 million contract . . . **General Electric** has received four Air Force contracts totaling $32.5 million. Production of radar equipment and the development of testing facilities for gas turbines make up the major part of the contracts . . . **Convair** division of General Dynamics has been given the green light for production of Skylark jet airliners. TWA and Delta Airlines are the most likely purchasers . . . **Rudel Machinery Co,** N Y C, has been appointed distributor for Norton precision grinding and lapping machinery in the New York area . . . A civil antitrust suit has been filed against **Dover Corp** of Washington, D C, and **Oliver Iron & Steel Corp,** Pittsburgh, who are charged with making exclusive-dealing contracts in connection with the manufacture of hydraulic elevators . . . Foundation and steel erection have been completed for the new 43,000-sq-ft plant of **Wagner Litho Machinery** in Secaucus, N J. They design, manufacture and install a complete line of automatic equipment for metal decorating . . . Winner of this year's $500 Metal Powder Association scholarship in powder metallurgy is Horace Pops, a junior in metallurgical engineering at Rensselaer Polytechnic Institute . . . A 57-acre building site in Edison Township, N J, has been purchased by **Alcoa** for a $1.5-million die-casting plant.

South . . .

Dixie newsnotes . . .

Chambers Manufacturing Corp has opened a million dollar plant at Oxford, Miss, to manufacture its gas and electric cooking equipment. The one story plant is nearly completely conveyorized . . . **Convair Fort Worth** has sub-divided its manufacturing organization into smaller segments because of the steadily increasing complexity of its projects . . . Construction will begin immediately on a new all-metal aircraft modification building at **Lockheed's** Georgia Division at Marietta. Contract for construction has been let to **Van Winkle Co** of Atlanta . . . **Duplan Corp** property in Grottoes, Va, has been sold to **Reynolds Metals Co** . . . Panel discussions of apprenticeship problems will be held at the **Eighth Annual Southern States Apprenticeship Conference** at Biloxi, July 5-7 . . . **Bullard Industries Inc,** Newport, Tenn, has purchased the machinery and equipment of **Wall Wire Products Co,** Plymouth, Mich, for a reported $10 million . . . **General Zipper Corp**

Foundry — East's Most Modern

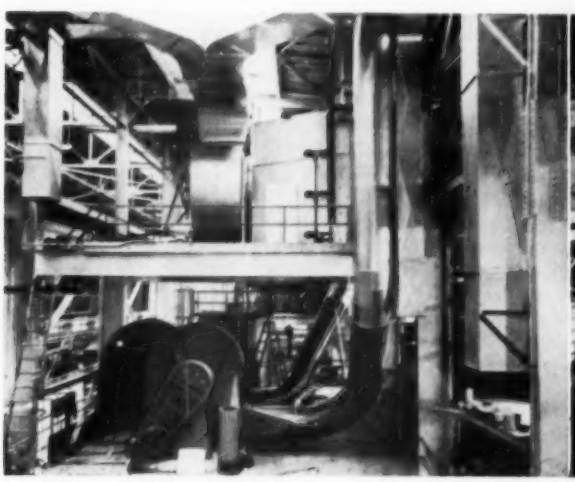
Clear space between the foundry's floor and cranes is 35 ft, and crane service (17 units) and work flow is such that there is no waiting for cranes or interruption of operation by passing loads.

While the new facility is not much larger physically than the old Bullard foundry, its capacity to produce more and bigger castings, and its headroom are all greater than before.

Mechanized small core department has mechanical sand conditioning and slinging facilities, with work finished on a merry-go-round and carried to the drying room by conveyor.

High-pressure water wash room removes cores and sand from castings in a small fraction of the time required by hand methods, and is responsible for much of the shop's cleanliness.

Cupolas are equipped with modern fly-ash collectors, with a central sluicing system carrying off the fly-ash and slag. Molding sand is recovered in a settling system, with virtually all water in the operation recovered and re-used.



One air change every 15 minutes . . .
by this huge, 512,000-cu-ft ventilating system keeps the shop clean, provides Bullard's foundry with excellent foundry working conditions

Inside storage bins . . .
hold scrap iron, pig iron, sand and other foundry materials. They're a big factor in avoiding delays caused by inclement weather—a foundry bugaboo

Field Report USA:

is opening a branch plant in Miami . . . From Paris comes the announcement of another step in the expansion of **Dresser Industries Inc.** A newly formed French subsidiary will represent several Dresser industries in France and will provide technical services for their continental operations . . . Only Governor Earl Long's signature is lacking for repeal of Louisiana's 1954 "Right to Work" Law, which forbids compulsory union membership. Indications are he'll sign it soon.

Midwest...

Around the West . . .

Bethlehem Pacific Cost Steel Corp has disclosed plans for a $12-million expansion program at its San Francisco shipyard. Machine shop improvements will cost about $1 million, and the construction of the nation's largest floating drydock about $10 million. New piers and wharfs will also be built . . . A plane which will be able to take off straight up and land without any ground run and yet resembles a conventional light plane, will be built for the Army by **Ryan Aeronautical Co,** San Diego . . . Formation of **Farnsworth Electronics Co**, Pacific Division, is announced following the acquisition by Farnsworth of the **Bennett Products Manufacturing Co** of Palo Alto, Calif. Vinton D Carver is vice president and general manager of the new division . . . **Solar Aircraft,** San Diego, has received multi-million dollar orders for the company's gas turbine engines and jet engine components . . . Union employees of **Boeing Aircraft Co,** Seattle, recently accepted a two-year contract which calls for a 5% wage increase the first year, and an automatic increase of 7¢ an hour during the second year . . . **Consolidated Electrodynamics Corp** announces the completion of its $1.5-million research, engineering and marketing building in Pasadena . . . Oakland plant of **American Can Co** will be expanded to house new manufacturing facilities to process tin and steel plate from continuous strips . . . **Pioneer Mfg Co,** manufacturers of water heaters, garbage disposals, and house heating equipment, expects to start construction in September on a $1 million plant in Puente, California . . . **Studebaker-Packard's** Los Angeles plant shut down June 8 for an indefinite period to allow sales to "catch up with production." It had been turning out 64 cars a day . . . **Utility Mfg Co,** Los Angeles, expects to move into a new 350,000-sq-ft plant by the end of July . . . **Yale & Towne Mfg Co** has purchased a site near San Leandro, Calif, for construction of a multi-million dollar manufacturing plant . . . **Siegler Corp** is acquiring **General Water Heater Corp**, Burbank. Included in the transaction are General's subsidiaries, **Superaire Corp** and **Consolidated Machinery & Supply** . . . **Ryan Aeronautical** is doing extensive tooling to prepare for volume production of major components for **Boeing** and **Douglas** jet transports . . . **Aerojet** will build $13 million plant incorporating development and production at Sacramento . . . **Shallway International Corp,** Palo Alto, Calif, foundry sales and service company, has announced the opening of an office in Dusseldorf, Germany, to serve Europe, Africa, and the Middle East.

West...

Midwestern briefs . . .

A new laboratory, which will test turbojet and turboprop parts and assemblies for the Navy, is to be operated by **Thompson Products Inc,** Cleveland . . . Third Annual **American Society of Training Directors Institute** will be held at Michigan State University, July 9-13, 16-20 . . . Completion of facilities for developing and manufacturing custom-made grades of cemented carbides was announced recently by **Walmet Corp,** Madison Heights, Mich . . . **American Brass Co** has broken ground for an integrated aluminum mill at Terre Haute, Ind. Construction cost of the 500,000-sq-ft plant will amount to about $25 million . . . **Continental Can Co** has opened a new research and development center in Chicago. Includes equipment for designing and testing new can-making machinery and laboratory facilities to develop new packaging uses for cans . . . Cleveland's Wade Park Manor Hotel will host the second annual National Sales Conference to be held by **National Screw Machine Products Association,** August 7-8 . . . **Pullman-Standard Car Manufacturing Co** announced recently that it is going to sell about 80 acres of property, including 26 buildings at its works near Chicago . . . **Illinois Central Railroad** is planning to place orders for 70 more general purpose diesel-electric locomotives next year. Orders will total $12 million . . . **International Harvester** will lay off 2380 employees this month in its farm machinery plants because of declining sales . . . **Lincoln Electric Co,** Cleveland, has announced an $8-million expansion to its plant capacity for manufacturing arc welding machines and electrodes. Manufacturing capacity will increase 60% . . . About 65,000 people toured **U S Steel's** four plants in Gary, Ind, last month as part of the corporation's participation in the city's 50th anniversary celebration . . . All time record for steel production was set by steel mills in the Chicago area during the first five months of '56 when over 9.5-million tons were produced. Each month this year has set a monthly record . . . Construction of an additional office building will begin this year at **Allis-Chalmers'** West Allis (Milwaukee) Works . . . **Power Products Corp,** Grafton, Wis, has opened a new $1-million, 117,000-sq-ft plant and office building. The company, one of the country's biggest manufacturers of light gasoline engines, is now producing about 20,000 engines per week . . . Toledo's good labor climate and productivity rate have led 24 companies to locate or expand their plants there in the last 2½ years, creating 7000 new jobs . . . Heavy expenditures for plant and equipment by industry have resulted in a record peacetime backlog of orders ($64 million) for **E W Bliss Co,** Canton, Ohio . . . Approval of three more building projects has been announced by **Trane Co,** La Crosse, Wis . . . **Mall Tool Co,** Chicago, makers of power tools, has been purchased by **Remington Arms Co.** Remington will add a few representatives but present personnel will be retained . . . Waterway projects now under way in Chicago's Calumet Harbor area will, when completed, bring more than $3 million in new factory development and, over the next 20 years, will create 750,000 new jobs . . . **Luria Engineering Co** broke ground recently for its 91,200-sq-ft steel fabricating plant near Chicago . . . Products at the new **General Electric** Industrial Heating Dept plant, Shelbyville, Ind, will range from 5-story high industrial furnaces to pencil size heaters used in small soldering irons . . . **All Steel Equipment Inc,** Aurora, Ill, makers of steel furniture, have purchased a 48-acre tract for plant expansion.

Albert H Dall (left), director of standard machine tool engineering and development for Cincinnati Milling Machine Co, has been elected a vice president of Cincinnati Milling & Grinding Machines, Inc, sales subsidiary. **Charles M Reesey,** advertising manager of the parent company, and a member of the National Machine Tool Builders Association advertising committee, has also been elected a vice president of the subsidiary

Austin D Lucas, president of Austin D Lucas & Co, Bridgeport, Conn, has been elected president of the Machinery Dealers National Association (Other officers listed below)

Names in the News . . .

Lawrence L Garber, general manager of H K Porter Co's Henry Disston Div, Philadelphia, has been named to the new post of vice president, production, for the company. **Eugene Salinger,** assistant general manager of the Riverside (NJ) Metal Div, succeeds Mr Garber.

Frank Curtis, Detroit district manager of Morse Twist Drill & Machine Co, New Bedford, Mass, has been named carbide tool coordinator for the organization. **Lewis Campbell** succeeds Mr Curtis at Detroit; **Frank C Johnson** has been appointed Ohio district manager.

D M Stevenson, midwestern sales manager for Skinner Chuck Co, New Britain, Conn, has been elected vice president, sales. **G A Goepfrich,** chief engineer, has been named vice president, engineering.

William L Martin, assistant sales manager of Potter & Johnston Co, Pawtucket, RI, has been promoted to sales manager.

Clark R Hibbard has been appointed sales manager of Fosdick Machine Tool Co, Cincinnati, Ohio.

H L Tigges, former executive vice president of Baker Bros, Inc, Toledo, who retired to open his own consulting engineering firm, has been appointed consulting sales engineer for Buhr Machine Tool Co, Ann Arbor, Mich.

J Robert Tomlinson, executive vice president of the Barden Corp, Danbury, Conn, has been elected president of the precision ball bearing manufacturing company. He succeeds **F E Ericson,** who has resigned.

Harold M Schafer, manager of tooling at Caterpillar Tractor Co's Aurora Plant, has been promoted to manufacturing manager. **William T Gabbett** has been named purchasing agent; **Louis G Frank,** chief engineer of Trackson Co, Milwaukee subsidiary, has been appointed chief engineer at Aurora.

Alphons J John, advertising director of Kearney & Trecker Corp, Milwaukee, has been named manager of employee and community relations for the company. He is succeeded as advertising director by **Hal W Francke,** since 1946 a member of K & T's sales force. **Harold W Kippers,** sales manager of the Special Machinery Division, has been named sales manager of the Standard Machine Division. He is succeeded by **Carl F Enroth,** formerly a special machinery sales engineer. Also named to new posts are Personnel Manager **Rudolph F Kertz**—to staff assistant to the vice president of industrial relations; **R O Tjensvold,** formerly personnel director of Nash Division, American Motors Corp, to manager of labor relations; and **Joseph P Bliss,** coordinator of co-op and graduate training, to manager of training.

Charles Kempler, Interstate Machinery Co, Chicago, has been elected 1st vice president of the Machinery Dealers National Association. **Arnold Borgman,** J L Lucas & Son, Bridgeport, Conn, has been named 2nd vice president; **Elmer W Pfeil,** Elmer W Pfeil, Inc, Cleveland, is new treasurer; and **R K Vinson,** Washington, DC, is executive director.

Andrew E Josephson has been named production manager and director of purchasing for Jarvis Power Tools, Inc, Middletown, Conn, subsidiary of the Jarvis Corp.

OBITUARIES

Frank A Poor, 76, a founder and vice chairman of the board of Sylvania Electric Products, died June 17.

Joseph F Taylor, 67, chairman of the board and former president of Bausch & Lomb Optical Co, died June 13.

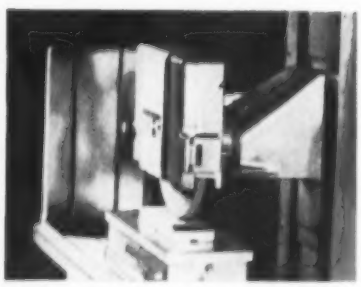
Robert I Bickford, 66, supervisory mechanical engineer in the Navy Bureau of Ships' Industrial Tool & Equipment Branch, died June 7. He had been in charge of the technical development of the Bureau's single service mission of specifications for hand tools used by the entire Department of Defense.

Dr Charles R Austin, 58, assistant to the president of Meehanite Metal Corp, New York, died May 31.

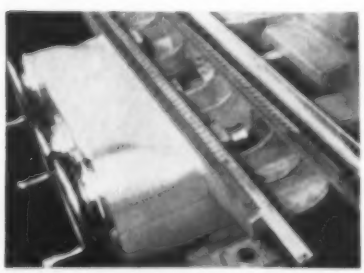
Samuel I Fink, 63, head of the Franklin S Miles Co, Philadelphia manufacturer of screw machine products, died June 1.

New Shop Equipment,

Hand-Feed Precision Surface Grinder Is Built for Smoothness, Ruggedness



WHEELHEAD receives spindle cartridge assembly, moves on column ways, is provided with adjustable gib for ease of adjustment. Assembly is balanced on elevating screw mounted between column ways



SADDLE is special close-grain casting of deep box construction. Depth is 5 in. Tested at 50% overload, it showed no measurable deflection at any point

Abrasive Model 618 precision surface grinder is equipped with horizontal spindle, reciprocating table, and hand feed. Comparatively small unit —capacities are 18-in. longitudinal, 6-in. transverse, and 12-in. vertical— is ruggedly built to maintain accuracy.

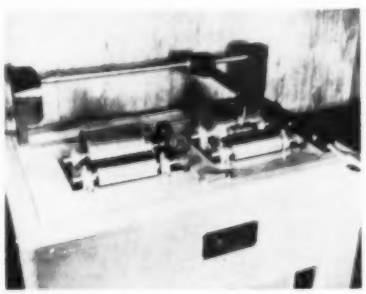
To provide positive grinding control, roller-bearing ways, back-lash eliminator on the saddle feed, and a special table cable-and-drum drive have been incorporated in the design.

Machine is the right size for most work on progressive dies, where the front-to-back dimension is the important thing, and it is also suitable for production use. Table hand-feed can be controlled at left of machine, as the operator watches action of the wheel on the die part or form; for production work, handwheel can be placed at the right side of the machine for production stroking of the wheel on the work.

Motorized spindle is of wide-diameter cartridge design and is totally enclosed, dynamically balanced, and lifetime lubricated. Machine can be equipped with a 12-in. grinding wheel powered by a 2-hp, 1750-rpm motor, or a 7-in. wheel with a 1-hp, 3450-rpm motor. Optional equipment includes wet-grinding attachment and Dustsnaire dust exhauster and separator, together with numerous other conventional devices.

Machine occupies a floor space of 50 x 85 in., has net weight of 1520 lb.

Abrasive Machine Tool Co, Dexter Rd, East Providence 14, RI



Centerless Lapping Machine Features Hold-Down Device

Capable of finishing cylindrical work to tolerances of 10 mu-in., centerless lapping machine can be used to lap oversize bearings and gages, bearing races, bushings, and shafts, as well as to salvage worn gages by lapping to the next smaller size.

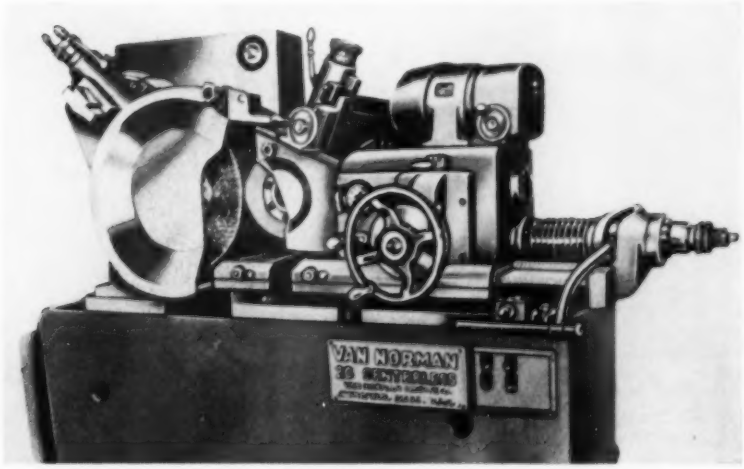
Unit features an easily manipulated hold-down device by which pressure is applied to the piece being lapped or sized. Lapping is done by means of two power-driven rollers, one considerably smaller than the other. Smaller roll turns work, which is placed between the rolls, at a constant speed.

By a simple adjustment to vary the space between the rollers, the machine will lap any diameter from 0.010 in. to 6 in. Amount of pressure applied to work governs the amount of stock removed. High spots may be lapped by applying sustained pressures at those points, and shoulders may be lapped by allowing work to overhang machine rolls.

Available as an accessory is an abrasive roll with attached handles which is used to condition the lapping rolls without removal from the machine. In use dresser is simply held between revolving rolls until the desired condition is attained.

Size Control Co, 2500 W Washington Blvd, Chicago 12, Ill

Materials and Parts . . .



Van Norman Centerless Grinder Performs Three Types of Work

No. 2C centerless grinder, a heavy-duty unit, does the work of three centerless grinders without change-over time. It is a standard centerless grinder for throughfeed work; a standard grinder for infeed jobs; and, equipped with crush-drussing attachment, it form-grinds and does profile work. Unit finish-grinds parts from solid or finish-grinds rough-turned parts.

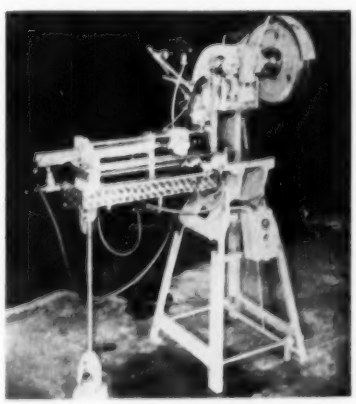
Vee and flat table ways are hand scraped and hard-chrome plated. Grinding-wheel spindle is totally enclosed, with permanently sealed bearings of double-row construction. Spindle requires no warm-up period, eliminating "creep" troubles.

Regulating-wheel drive motor is an infinitely variable 1½-hp unit. Main drive motor of 15 hp is totally enclosed and dynamically balanced. There are independent hydraulic wheel-truing devices for each wheel.

Other specifications: work capacity, 0 to 4¾-in. dia; grinding wheels available, 24 x 4 x 12, 24 x 6 x 12, and 24 x 8 x 12 in.; regulating wheels available, 12 x 4 x 5, 12 x 6 x 5, and 12 x 8 x 5 in.

Wheel speeds have low range of 10 to 57 rpm, high range of 60 to 355 rpm. Net weight is approximately 9500 lb.

Van Norman Machine Co, Springfield 7, Mass



Air-Operated Slide Feed Provides 12-in. Feed Length

Model ASE-12 open-throat, air-operated slide feed, shown attached to a small OBI press, features feed lengths adjustable up to 12 in. Longer feed lengths are possible by using a counting device which can be supplied as an extra.

Width and thickness capacity of unit are as follows: up to 15-in. wide by 0.032 in. thick; 12 in. wide by 0.062 in. thick; and 6 in. wide by 0.125 in. thick. Mechanical connections to the press are not required.

U S Tool Co, Ampere (East Orange), NJ

. . . including

MACHINE TOOLS AND ATTACHMENTS

Spline-Rolling Machine 147
Horizontal Broach 148
Four-Head Belt Grinder 150
Gap Lathes 154
Automatic Drilling Unit 168

TOOLS AND ACCESSORIES

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NEW SHOP EQUIPMENT, MATERIALS, AND PARTS

Crank-Driven Hammers Balance Force In GFM Automatic Forging Machines

A machine for precision forging of shafts or tubes, based on the application of simultaneous blows from four hammers has been developed by GFM, Steyr, Austria. With hydraulic cycle control, the machines can be equipped for automatic cycle so that up to eight different cross sections can be forged on one piece. Diameters are set by stop pins on index drums; tapers by templets.

Tolerances that can be held in hot forging are said to be ± 0.012 in. on OD and ± 0.004 in. on ID (over a mandrel); in cold forging the tolerances are ± 0.004 in. on OD and 0.0004 in. on ID.

HOW IT WORKS

In the forging case are three to six eccentric shafts that revolve rapidly. The eccentric in the shaft transmits the forging force through a connecting rod to the hammer. Because all hammers strike at the same time, the forces are balanced and no ground vibration is produced.

Each eccentric shaft (see sketch) is supported in an adjustment housing that is itself eccentric. Thus by adjusting all eccentric housings at once, the hammer strokes can be shifted toward or away from the work, changing the diameter of the forged work. This is accomplished by gears flanged to the housings, all operated by a central sun gear that is driven through a rack and pinion by a hydraulic cylinder.

Movement of the cylinder controlling work diameter is determined by adjustable stops or templets set on an index drum. At the same time, the vertical movement of the chucking head is controlled by the adjustable stops on a second index drum. Movement of the two index drums is coordinated through worm gears.

SCHEMATIC DIAGRAM of eccentric housing and eccentric adjustment for one forging hammer in GFM machine. Design relationship is maintained between diameter Dv of adjustment housing and the eccentricity E of the eccentric shaft

In the design of the machine a specific ratio is maintained between the diameter of the adjustment housing and the eccentricity of the bearings. This ratio is said to be such that the moment of friction of the applied forging force holds the adjustment housing and prevents slipping out of adjustment. All hammer adjustments take place during times when the hammer is not in contact with the work.

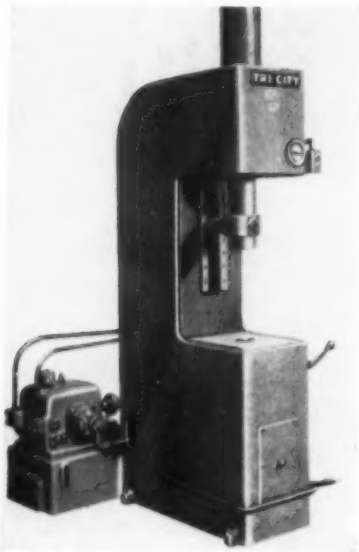
Work is held in an air chuck. Chuck jaws are pedal controlled for loading and unloading. The chucking head feeds the work between the hammers, rotating it between blows and halting during impact. When forging splines, flutes, or other non-circular shapes, the chuck feeds without rotation.

Forging hammers are made of alloy tool steel with a Stellite surface welded on. Hammer life is said to be 1000 to 2000 pieces before regrinding is necessary, when holding close limits. When tolerances are less critical, up to ten times as many forgings can be made without hammer changes. A hammer change is said to require about 30 min, a complete setup change about 3 hr.

Originally developed to cold forge finished rifling into gun barrels, the GFM forging machine can be used for solid and tubular shafting that requires contours or shoulders, axles, pressure cylinders, pipe couplings, bearing races, and other parts.

The largest standard vertical GFM machine is illustrated. It has four hammers, each striking 540 blows per minute with a force of 132 tons. This machine will forge pieces to 5-in. dia and 48-in. length. Larger work is handled in horizontal machines operating on the same principle.

Imported by Girard Associates, Chambersburg, Pa



Tri-City Gooseneck Presses Have Sensitive Ram Control

Ranging in capacity from 6 to 25 tons, four types of high-speed gooseneck presses with fluid-power drive are offered. Machines are designed for assembling, broaching, straightening, and stamping operations.

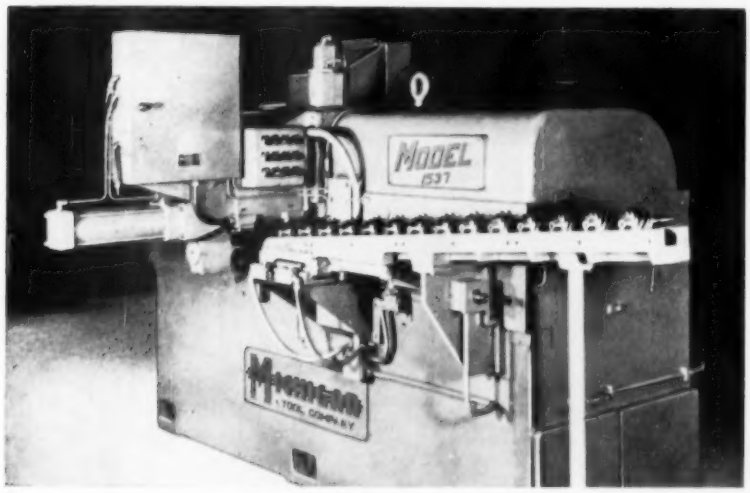
Sensitive controls give operator every desirable ram action through a hand lever or foot pedal. For each size of press, there are two sizes of variable-volume pumps, one with ram speeds for general purposes, another with higher speeds for greater production requirements. Pumps are equipped with adjustable relief valves for protection against press overload.

For varied production requirements, Type H presses with working-height platens and Type L with low platens are recommended. For production of identical pieces over medium or long runs, Type FL and FH presses are available.

Extra equipment offered includes semi-automatic control with distance reversal, semi-automatic control with pressure reversal, single or dual pushbutton control, special ram noses, and automatic pressure unloading control pumps. Catalog 1-16.

Tri-City Tool & Machinery Corp, 513 51st Ave, Rock Island, Ill

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



Michigan Spline-Rolling Machine Does Three Operations in One Pass

Roto-Flo Model 1537 spline roller can roll a spline plus an adjacent thread or oil groove in a single pass of the forming racks. Under certain conditions a third operation, such as marking, can be added. Operations can be performed on same or different diameters, but the forms to be rolled must be close together along the length of the shaft.

Roto-Flo process is one in which the metal periphery of a part is displaced from its undisturbed condition by cold working until it assumes a desired shape such as spline or serration. Entire process takes place in a matter of seconds as a continuous operation. Machines for process are available as manually loaded models or as automated units which can be operated through the complete forming cycle without attention from operator.

Model can handle parts with diameters ranging from ½ to 2 in. Rack lengths are available up to 36 in., with maximum stroke length of 42 in. Part lengths that can be accommodated by either standard or universal overarms available range from 6 to 36 in. Machine is 104 in. long, 74 in. in depth, and 72 in. high. Power for the forming racks is provided by a 20-hp motor.

Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich

Lincoln Motor Line Has Extruded-Plastic Insulation

Linc-Weld motors, available in standard sizes from 1 to 40 hp, are built in open-type frame and torque design B. Motors comply with NEMA specifications.

Thermo-setting plastic insulation is molded into and around the stator windings. Motor stator is placed into a die and the plastic material is forced into the die under heat and pressure. Liquid plastic resin is extruded through the stator slots, completely covering the stator winding.

Company states that even though motor is built in the open-type frame, it may be used as a splash-proof motor, as well as a totally enclosed motor in many applications.

Lincoln Electric Co, Cleveland 17, Ohio

Raybestos Cutting Tool Has Bonded Ceramic Tip

Marketed under the name Keramik, cutting tool has a ceramic tip bonded to a steel shank, eliminating the more conventional need to clamp ceramic bits in a holder. No. BR-8-M and No. BL-8-M are offered in a standard size of ½ in. by ½ in. by 3½ in. with a lead angle of 7°. Tip is an oxide-base ceramic.

Maker reports that tool will produce a fine finish, when properly ground, that is comparable to a commercial grind, and that it will cut materials that most carbide-tipped cutting tools cannot cut.

No cutting oils are necessary. Cutting tip runs cool, and chips will not weld to it. Because of low thermal conductivity, there is no build-up on the cutting edge and no cratering. In addition, tool is non-absorbent and unaffected by corrosion.

Company reports that it is equipped to do custom tipping to meet specific requirements.

Raybestos Div, Raybestos-Manhattan, Inc, Bridgeport, Conn

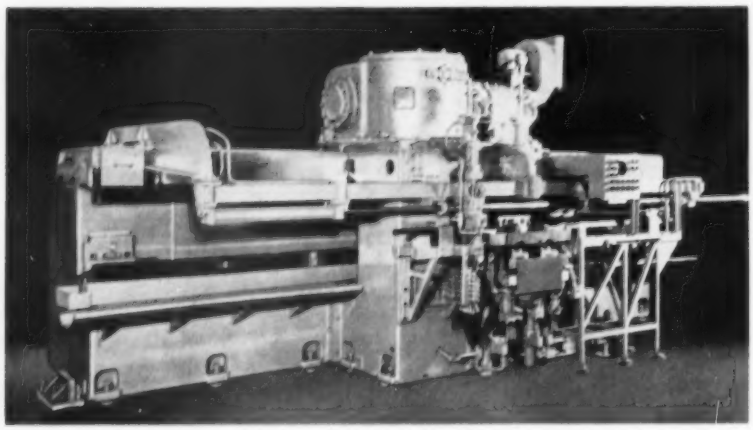
Red Ring Gear Checker Inspects Large Spur Gears

Red Ring Model SIC 24-in. gear checker inspects spur gears up to 25½-in. OD as well as splines for accuracy of tooth size, spacing, eccentricity, and parallelism. Work up to 11⅜-in. between centers can be accommodated on the machine.

Slot design in the table surface permits various checking units to be positioned in straight-line and right-angle locations. Slot has a combination of straight and angular lines said to offer greater accuracy and more hold-down power than more conventional devices. Gears to be checked are mounted between centers on head and tailstock units that are slidably mounted through the slot. Interchangeable heads are provided for checking eccentricity and size combination, along with tooth-to-tooth spacing.

Parallelism of each gear side or spline tooth is checked by a double indicator head unit mounted in a ball-bearing slide unit in front of the part being checked. Slide unit has 9-in. travel and moves indicator finger across the tooth face.

National Broach & Machine Co, 5600 St Jean Ave, Detroit 13, Mich



Colonial Horizontal Broach Tranfers Parts Automatically

Model 60-90 ElectroGear horizontal broaching machine features infinitely variable ram speeds from 30 to 150 sfm and automatic transfer of parts into and out of the work station. Work moves through the broaching station from right to left, in the same direction as the cutting stroke of the broach.

Entire broaching cycle is automatic and does not require an operator. Work is fed by conveyor into the loading station at the right of the machine, where a transfer bar moves it onto a hydraulic trunnion fixture at the center of the machine. Fixture swings up, positioning the part for the broaching pass. At the completion of the pass, fixture swings down, feeds another part, and at the same time the completed part moves into an automatic unloading station at the left.

In a typical application, company reports that unit broaches gasket faces on automative cylinder heads at a rate exceeding 200 parts per hour, within a tolerance of 0.002 in. Either carbide or HSS broaches can be used.

Power for ram is supplied by a dc motor. Floor space required is 194 by 290 in., and over-all height of the unit is 96 in.

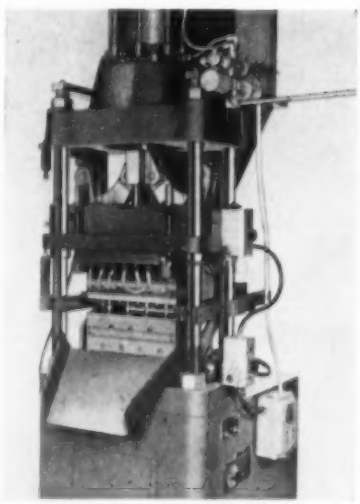
Colonial Broach & Machine Co, PO Box 37, Harper Station, Detroit 13, Mich

Electronic Unit Controls Plunge-Grinding Operations

Electronic unit known as Microtrol Type 150 is designed for the automatic control of plunge grinders. Unit gages work diameter continuously during grinding and uses the gaging information for automatic control of final size of work.

Used with a grinder that is equipped with electrically operated feed control and wheel-withdrawal devices, unit automatically controls such variables as the change from fast infeed to slow, amount of stock removal during sparkout, and wheel withdrawal at final size. In addition, part size is continuously presented on a set of direct-reading indicators, and lights signal arrival at the various size limits.

Airborne Instruments Laboratory, Industrial Products Dept, 160 Old Country Rd, Mineola, NY



Compression Molding Machines Feature Automatic Operation

Capable of cycling in four seconds, Automold Models A50 and A25 compression molding machines are designed to operate automatically with no operator required. Machines can feed any standard thermosetting materials, including alkyds.

All moving parts are mechanically positive, and the only electrical items in the units pertain to heating of the mold, timing the curing cycle of molded parts, and one limit switch for safety.

Press utilizes an air-operated cylinder, together with a toggle mechanism which slows platen toward the end of the stroke, to achieve proper molding technique. Any number of cavities may be used, provided the total number does not exceed 25 or 50 tons capacity. Feeding mechanism is cammed into the opening and closing of the press. Telescoping tubes predetermine the correct charge. Parts are ejected by lifters placed on the core side; by means of ejector pins, parts are stripped from the cores and deposited on an inclined table, part of the feeding mechanism, where they are sent to their respective bins.

Model A50 has platen area of 14 x 6 in., stroke of 7¾ in., min daylight with press closed of 15 in. and maximum of 19 in. Model A25 has 12 x 6 in. platen area, 6⅝ in. stroke, and max and min daylight with press closed of 15 and 13 in. Both models require air pressure of 120 psi.

Automatic Molding Machine Co, 3217 Exposition Pl, Los Angeles 18, Calif

Heavy-Duty Platen Conveyor Offered in 100-ft Lengths

Platen conveyor called Conveymatic is available in standard models up to 100 ft, with special models of greater length available on request. In general, conveyors can be lengthened in 10-ft multiples.

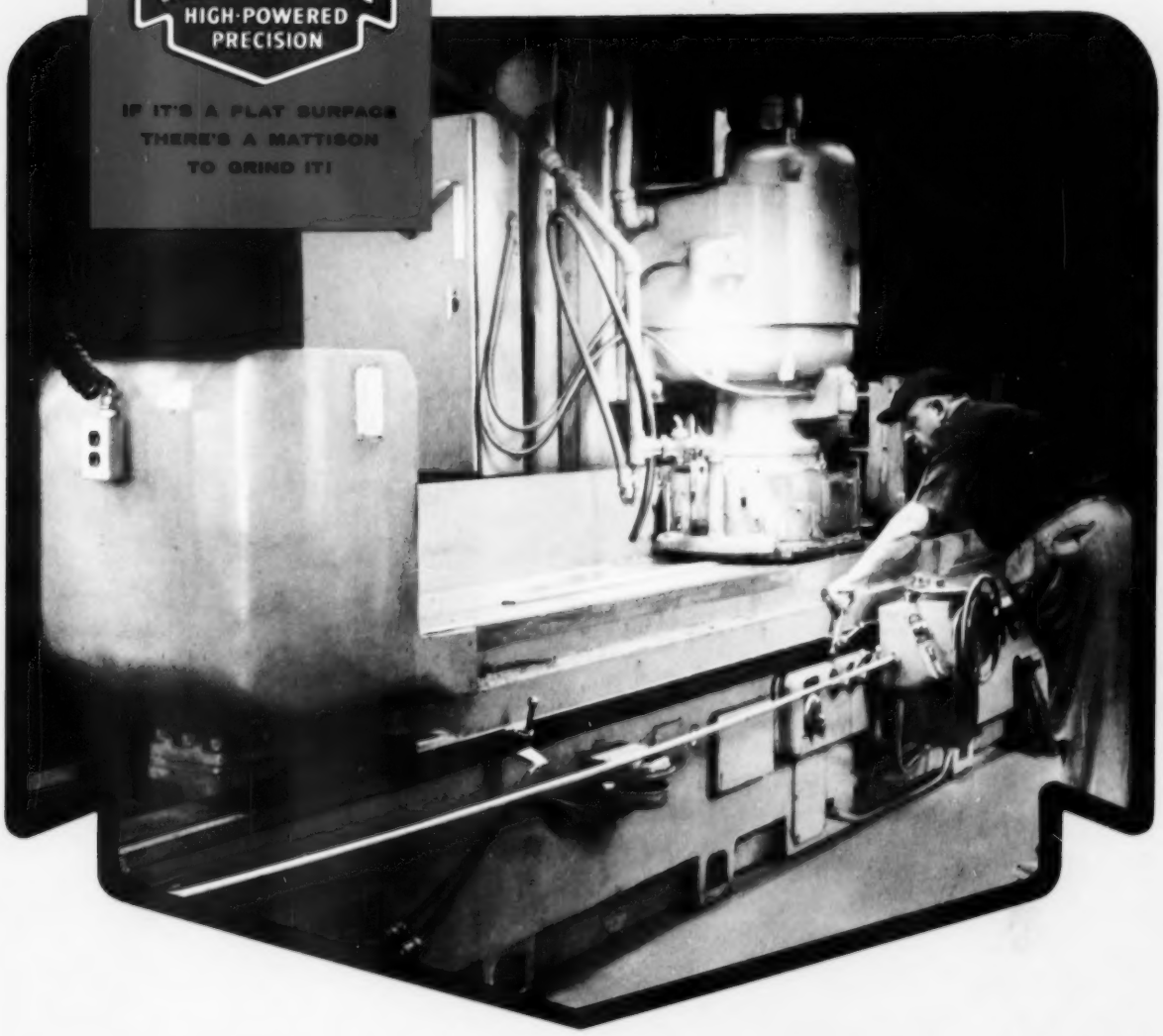
Units include the following features: jig-drilled, interchangeable 10-ft sections; working heights of 36, 38, or 40 in.; 12-in.-long steel platens, each providing 12½-in.-wide working area; 4000-lb chain pull; continuously variable speed range from 100 to 300 ft per hr; overload cut-out clutch; and right or lefthand offset drive.

Optional features available include in-line or vertical drive, automatic lubrication, intermittent or index motion, and arrangements for clamping and unclamping of parts, plus loading and unloading devices of all types.

Visi-trol Engineering Co, 9345 Hubbell, Detroit 28, Mich

MATTISON
HIGH-POWERED
PRECISION

IF IT'S A FLAT SURFACE
THERE'S A MATTISON
TO GRIND IT!



GRINDING METHODS

Increase production, slash setup time in switch from planer to surface grinder!

Here's how high-powered surface grinding cuts costs in the plant of a large midwestern manufacturer of precision tools.

Broach inserts, formerly planed, are now ground on the Mattison Model 400 Vertical Spindle Reciprocating Table Surface Grinder. Production has been increased because this heavy, powerful machine removes so much stock, milling time has been reduced. Former production was 200 inserts per week on the planers—today inserts are ground at the rate of 700 per week! Whereas setup time *was* 45 minutes per load, now it takes only 50 minutes to set up and grind 20 pieces.

This grinder also is used for toolroom and maintenance work. An example is the job at the right—grinding large, 60 in. clamping fixtures for the toolroom.

"Mattison-equipped" subcontract shops can help solve your machining problems

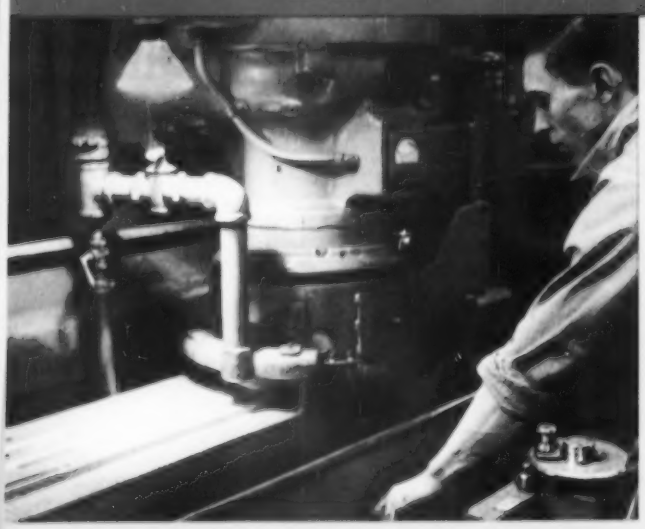
High-powered Surface Grinders prove small shop versatility!

Chicago Grinding and Machine Company, Chicago, Illinois, is one of hundreds of small plants throughout the country using Mattison Surface Grinders for precision machining of subcontract parts. Starting with their first "Mattison" in 1939, this company now has three No. 36 Vertical Spindle Rotary Surface Grinders and one High-Powered Horizontal Surface Grinder—machines which permit a small shop to handle diversified operations accurately and fast.

The jobs illustrated here prove the unusual versatility of Mattison Surface Grinders—versatility resulting from extra-heavy construction, high power, and simplicity of adjustment.

Large cast steel machine ends are ground top and bottom in six hours each, removing ½ in. stock. Parallelism over 47 in. dimension is held within .0015 in. Because of an obstruction, one side must be ground across the short dimension, and then "blended."

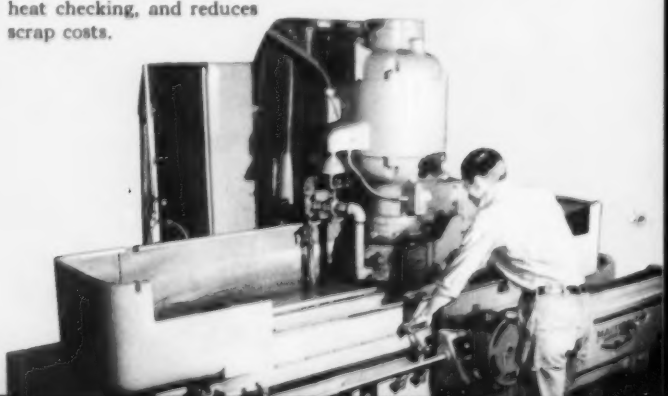
Mattison No. 36 grinds two sides of precision retainer rings at the rate of 100 per hour, holding size to plus .000 minus .003 in. Power and rigidity permit grinding these parts with only a slight wheel tilt, combining best stock removal qualities and maximum accuracy.



Large 48 in. and 36 in. shear blades are ground on the Mattison "No. 300" because it is 25 per cent faster than other grinders available in this plant. Aircraft counterweights are ground to plus or minus .0005 in. over their 15 in. length.

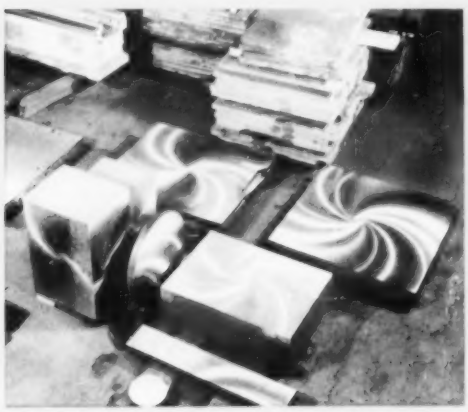
Material costs controlled by high-powered surface grinding

Machining metals worth up to $12.50 per lb is a precision job, and waste is prohibitive. In this plant, *seven* Mattison Surface Grinders are used for a variety of operations to control quality and costs. Minimum stock allowances reduce material costs and speed machining. Power of the Mattison Grinders promotes positive cutting action, prevents heat checking, and reduces scrap costs.



Large clutch plates ground with ease

At the right, large clutch plates are finish-ground in 20 minutes, holding size within .002 in. Plates have a 12½ in.-wide uninterrupted surface. For accuracy, the wheel must be set perfectly flat. Powered by a 60 hp spindle motor, the "Mattison" removes .020 in. stock and maintains high unit pressures for free-cutting action. There is no "rubbing" or excessive heat because the "No. 36" has the rigidity to maintain high unit pressures when grinding large, flat surfaces—characteristics that assure removal of stock at profit-boosting speeds.



Variety of work produced on Mattison high-powered surface grinders includes die blocks, machine parts, machine tool beds and tables, and many other low- and high-production jobs.

Can subcontract grinding help you?

Hundreds of "Mattison-equipped" subcontract shops like Chicago Grinding and Machine Company are anxious to pit their special grinding skills against your "trouble" jobs. These grinding specialists can machine almost any flat piecepart at high-production efficiency, producing an unusually accurate and fine surface finish. If you are now machining flat surfaces by other methods without completely satisfactory results, we will be glad to suggest several subcontract grinding shops with equipment capable of doing your job.

50 DIFFERENT MACHINES • SURFACE GRINDERS • FACE GRINDERS • DISC GRINDERS

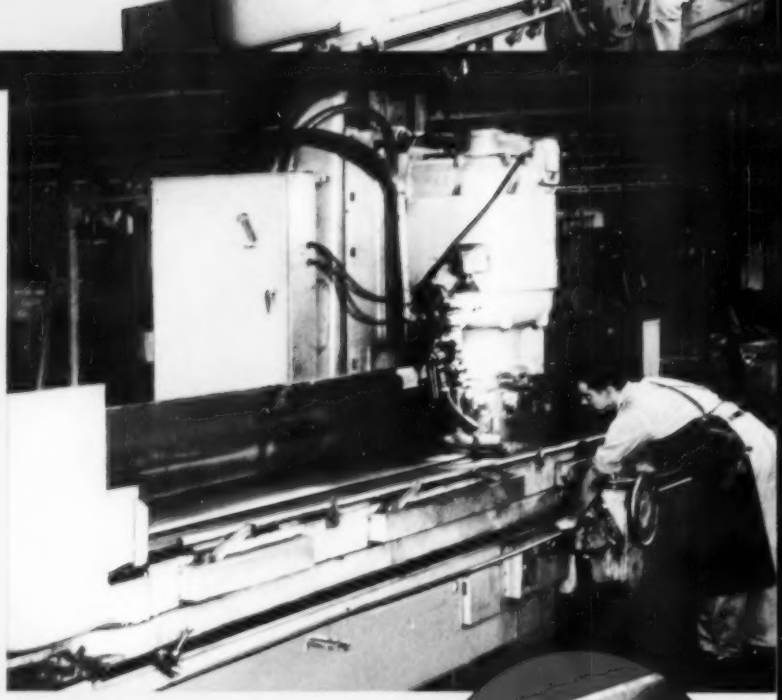
Accuracy and production increased 100%

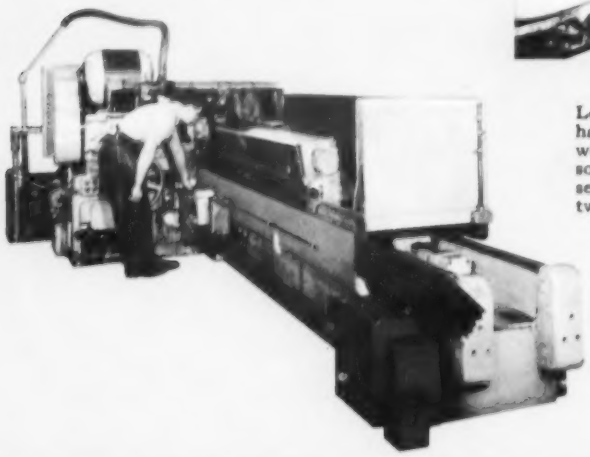
Both production and accuracy were increased 100 per cent by this Mattison user who grinds knives for paper-cutting equipment. Chrome-vanadium blades are difficult to grind because of the tough, low-carbon steel backing. Yet, flatness and straightness are held on the rough grinder within plus or minus .0015 in. Tapers are finish-ground to within plus or minus .00025 in. and concave surfaces are held to within plus or minus .0002 in.—results made possible by Mattison's exclusive double-column construction and high-powered design.

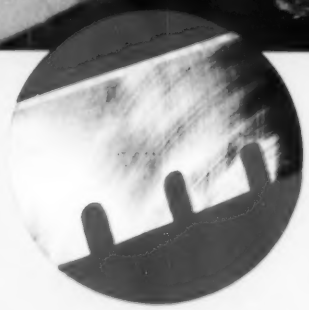
MATTISON
HIGH-POWERED
PRECISION
GRINDING METHODS

Increase production, improve quality, and reduce costs!

Mattison No. 400 Vertical Spindle Reciprocating Table Surface Grinders proved their profit power for this well-known manufacturer of industrial saws, paper-cutting machine knives, and files. Production has been increased with a resulting reduction in unit cost, and maintenance has been cut to a minimum.

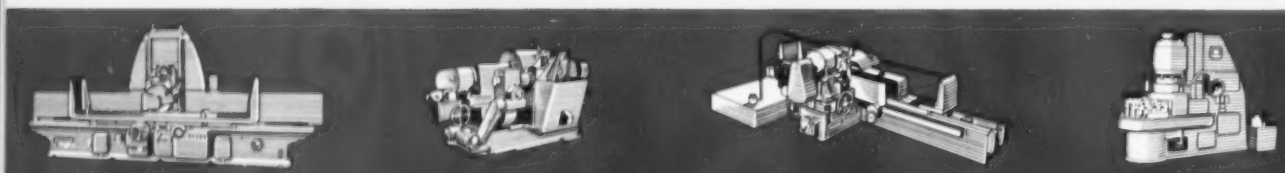






Low carbon steel blades are long and hard to handle, but they are ground with ease and accuracy on the Mattison. Ease of loading has helped reduce setup time and brought downtime between loads to the lowest possible point.

Left, bevels are ground on Mattison Traveling Table Face Grinder, with swiveling-type magnetic chuck for setting work at proper angle. These machines, particularly suited for face, knife, and shear-blade grinding, are available in table sizes up to 180 in. long.



IF IT'S A FLAT SURFACE...THERE'S A MATTISON TO GRIND IT!

Cost-cutting ideas . . . for production and process engineers

now available!

Mattison brings you authentic user reports demonstrating the versatility of surface grinding—newest method of metal cutting. High production with extreme precision are twin qualities to be found in almost every story. Many different products and materials are described in these reports.

Attach this coupon to your letterhead, and mail today!

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HIGH-POWERED PRECISION SURFACE GRINDERS

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MACHINES AND ATTACHMENTS

1 SINGLE SPINDLE BAR AUTOMATIC SCREW MACHINES—*Gear Grinding Machine Co, Detroit 11, Mich.* 16-page illustrated catalog gives detailed descriptions of Detroit Screwmatic 750. Covers construction and design; pictures and explains ten design features for easy setup; attachments available and specifications included.

2 UNDERDRIVE PRESSES—*Danly Machine Specialties, Inc, Chicago 50, Ill.* 32-page catalog illustrates and describes line of single, double, and triple-action units from 400 to 2000-ton capacities. Special design and construction features; specifications and dimensions; accessories pictured.

3 INJECTION MOLDING MACHINES —*Watson-Stillman Press Div, Farrel-Birmingham Co, Roselle, NJ.* 9-page bulletin 627-B contains illustrated information on hydraulic vertical units. Advantages and features described; specifications given for 1, 2, 6, 16, and 24-oz machines. 6-page illustrated bulletin 624 gives data on PE-64 preplasticizing-type unit. Improved design described; preplasticizing unit increases capacity of machine up to 90 oz; accessory equipment and specifications included.

4 RING AND CIRCLE SHEAR—*Niagara Machine & Tool Works, Buffalo 11, NY.* Illustrated bulletin 70 supplement gives complete details on No. 31-RC for cutting straight lines, irregular outlines, circles, circular holes, and rings. Specifications and extra equipment covered.

5 LIVE CENTERS—*Sturdimatic Tool Co, Detroit 16, Mich.* 4-page illustrated bulletin 256 describes and gives specifications and prices of standards, made with Morse taper, and three types of specials.

TOOLS AND ACCESSORIES

6 AIR GAGES—*Federal Products Corp, Providence 1, RI.* 32-page 1956 edition of Dimensionair catalog 56D explains principle, outlines 13 advantages resulting. Construction, design, applications, attachments illustrated and described. New items covered include matched Air-Probes; differential air meter, and Probe-X air attachment for Arnold continuous grinding gage.

7 MAGNETIC PERFORATING DIES —*S B Whistler & Sons, Inc, Buffalo 25, NY.* 21-page catalog M-55 illustrates, describes, and provides engineering data on dies for perforating materials up to and including ¼-in.-thick mild steel. Setting up of magnetic equipment pictured. Punching pressure chart and prices included.

● SPECIAL CHUCKS—*Garrison Machine Works, Inc, 515 Bannock St, Dayton 4, Ohio.* Brochure describes unusual applications of units designed and built by the company for locating and holding non-symmetrical or out-of-balance components during processing operations. Request direct on company letterhead.

8 TOOLS—*Weldon Tool Co, Cleveland 4, Ohio.* Spiral-bound catalog 11 contains progressive listing of tools by sizes with detailed dimensions. Covers end mills and holders, Tu-Lip counterbores, new countersinks and deburring tools, angular cutters, sharpening fixtures, and HSS and carbide form tools.

9 CHART, GRAPH, & LAYOUT EQUIPMENT — *Chart-Pak, Inc, Stamford, Conn.* 20-page catalog "Visualization Made Easier" illustrates and describes Chart-Pak method of "drawing" charts, graphs, and layouts with pressure-sensitive tapes and templets for mounting on plastic planning boards.

10 MACHINE SETUP KITS & BLOCKS—*Jergens Tool Specialty Co, Cleveland 10, Ohio.* Folder illustrates and gives specifications for 13 Tee Set kit sizes, each containing 4 extension nut couplers, flange nuts, T-slot nuts, strap clamps, and 24 studs with diameters available in ⅜, ½, ⅝, and ¾ in., with 3 T-slot nut sizes available for each diameter.

11 MOLY-SULFIDE IN CHASSIS GREASE—*Climax Molybdenum Co, New York 63, NY.* 8-page bulletin Lu-8a explains how the lubricant additive functions in chassis grease by depositing out of the grease in a thin film that adheres tenaciously to the steel in part being lubricated, even after grease is washed or wiped out

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of bearing. Properties and current technological status detailed.

PLANT SERVICE EQUIPMENT

12 POWER CONVEYORS—*Harry J Ferguson Co, Jenkintown, Penna.* 24-page catalog illustrates 19 different types for variety of applications. Gives size and dimension data for portable, stationary, horizontal, and inclined models, and floor-to-floor units, power belt corners, power roller curves.

13 SLOTTED ANGLE—*Dexion Division Acme Steel Co, Chicago 8, Ill.* Booklet contains photographs and descriptions of variety of applications for plant maintenance and equipment needs. Accessories illustrated include Dexion Cutter, steel panels for shelving or stair treads, and casters.

14 WIRE ROPE SLINGS—*American Chain & Cable Co, Wire Rope Sling Division, Bridgeport 2, Conn.* 4-page folder DH-532A illustrates and describes Acco Registered Cable-Laid slings with high flexibility, strength, kink-free construction, bright Galacco finish. Vertical, basket, bridle, or choker hitch styles available in variety of sizes.

15 SHOCK & VIBRATION CONTROL—*T R Finn & Co, Industrial Division, Hawthorne, NJ.* 4-page bulletin SVC-55 describes basic theory of vibration isolation and shock absorption; discusses various types, gives basic data, formulae and graphs, reviews practical methods of control.

16 FLO-KLEAN FILTERS—*Cuno Engineering Corp, Meriden, Conn.* 4-page bulletin 052 illustrates and describes units for raw water, light process liquids, and centralized coolant systems. Models are continuously and automatically self-cleaning, can filter down to 0.0025 in.

17 DEGREASER—*Permacel Tape Corp, New Brunswick, NJ.* Brochure describes new Permacel 345 for cleaning engines, machinery, aircraft bodies, floors, and grease pits. Product is sprayed on, hosed off. Data is also provided on Permacel 340 Bite, a pre-paint cleaner and wax and silicone remover; prepares old surfaces for good bonding of refinishing materials.

PARTS AND MATERIALS

18 VARIABLE SPEED TRANSMISSIONS—*Maurey Manufacturing Corp, Maureymatic Division, Chicago 16, Ill.* 11-page catalog illustrates and describes features and applications of four styles of Maureymatic transmissions for machines using up to 10-hp V-belt drives. Speed ranges up to 10:1 provided.

19 NICKEL & NICKEL ALLOY TUBING—*Superior Tube Co, Norristown, Penna.* 20-page catalog 12 tabulates mechanical properties and chemical compositions of 13 analyses of tubing. Section on selection and application describes characteristics of each analysis, illustrates typical applications.

20 ROLLER CHAIN & SPROCKETS—*Link-Belt Co, Chicago 1, Ill.* 148-page illustrated booklet 2457 covers complete line. Includes sections on stock drives, drive chain, conveyor chain, installation and maintenance, lubrication, sprocket wheels, casings, and chain tighteners.

21 GEARMOTORS—*US Electrical Motors Inc, Los Angeles 54, Calif.* 16-page bulletin 1880 provides illustrated information on various types of Synerogear motors. Outlines advantages, lists ratings from 1/3 to 30 hp with gear ratios to 10:1. Features of single, double, and triple reduction units described.

22 DIRECTIONAL CONTROL VALVES—*Oilgear Co, Milwaukee 4, Wis.* 16-page illustrated bulletin 80200 covers two-way valves for fluid power systems up to 3000 psi; eight pipe sizes from ⅛ to 3 in. Choice of plungers and flanges offered in five styles, mechanical, manual, hydraulic, solenoid, and solenoid pilot. Each described; type designation, dimensions, and JIC symbols included.

23 SNAP-ACTION SWITCHES—*Micro Switch, Division of Minneapolis-Honeywell Regulator Co, Freeport, Ill.* 16-page Micro Tips Digest contains 43 illustrated descriptions of applications.

24 EXPLOSION-PROOF MOTORS—*General Electric Co, Schenectady 5, NY.* 8-page bulletin GEA-6341 illustrates and discusses design features and maintenance of Tri-Clad 55 induction motors, 1-30 hp, for use in hazardous locations.

25 HYDRAULIC CYLINDERS—*Galland-Henning Nopak Division, Milwaukee 46, Wis.* 12-page catalog 104 describes units designated Class 4 for 2000-psi service. Engineering and dimensional data; features and parts illustrated in cross-sections; mounting brackets, rod clevises, and special cylinders described.

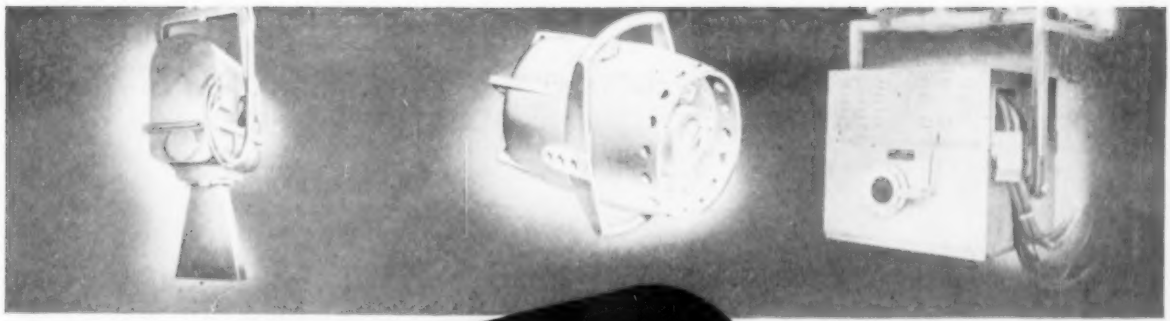
26 PERFORATED METAL SHEETS—*Harrington & King Perforating Co, Chicago 44, Ill.* 6-page brochure gives information on sheet sizes, type and gage of metal, and percent of open area. Perforated patterns illustrated.

27 EPOXY PLASTIC TOOLING MATERIALS—*Houghton Laboratories, Inc, Olean, NY.* Technical Data Sheets T-1 (4 pages) provide comparative data on Hysol epoxies. Advantages listed; tabular information on physical properties of cured systems; product descriptions and characteristics; applications and suggested methods. Technical Data Sheets T-24 (15 pages) contain description of materials and some of the techniques for use in duplicating patterns. Includes sections on casting and laminating processes, refacing, and general information.

28 LIMIT SWITCHES—*R B Denison Mfg Co, Cleveland 13, Ohio.* 4-page bulletin 356 describes 19 contact arrangements available with seven Loxswitch models for heavy-duty operation. Features illustrated; dimensions tabulated.

29 BERYLLIUM COPPER ALLOY—*Beryllium Corp, Reading, Penna.* 4-page bulletin describes physical properties of Berylco 10 Strip, a high-conductivity alloy. Contains data on features, applications, properties, composition and tempers available.

30 STRUCTURAL ADHESIVE BONDING *Narmco Resins & Coatings Co, Costa Mesa, Calif.* 20-page illustrated brochure discusses techniques and advantages. Contains technical data on high-temperature adhesives for metal-to-metal and sandwich applications.



New Kodak X-ray Film for shorter exposures and quicker examinations

Kodak Industrial X-ray Film, Type AA

Read what the new Kodak Industrial X-ray Film, Type AA, will do for you.

- Reduces exposure time—speeds up routine examinations.
- Provides increased radiographic sensitivity through higher densities with established exposure and processing technics.
- Gives greater subject contrast, more detail and easier readability when established exposure times are used with reduced kilovoltage.
- Shortens processing cycle with existing exposure technics.
- Reduces the possibility of pressure desensitization under shop conditions of use.

Here is a brand-new x-ray film that gives you greatly increased film speeds. It is a film that retains the fine sensitivity characteristics which have made Kodak Type A the most widely used x-ray film in industry. Then in addition it gives speeds up to more than double those of Type A.

This means that you can cut down exposure time, handle routine examinations more quickly.

Your x-ray dealer and the Kodak Technical Representative are ready to tell you all about this new film. Get in touch with them. See what it will mean to you.

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N. Y.

Kodak

Prodex Plastics Extruder Has Automatic Thermo Control

No. 57 plastics extruder with improved design features has an automatic thermo control with electronic three-position temperature controllers that automatically actuate stainless-steel heaters and turbo air coolers.

Heavy-duty thrust assembly consists of an extra-heavy thrust bearing of spherical-roller type. Drive shaft and thrust bearing are supported by two widely spaced radial bearings. Unit also has a herringbone-gear transmission and a flexible coupling between the gear transmission and thrust bearing to protect the gear transmission from mechanical shock.

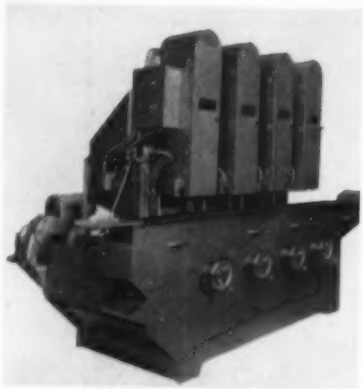
Control cabinet has harness wiring and terminal-strip construction. It contains all temperature controllers, individual zone ammeters, contactors with pilot relays, and individual fuses for each circuit. Built to JIC standards, it is gasketed and dustproof.

Equipment is available with length-to-diameter ratios of 16:1, 20:1, and vented 24:1 in 2½, 3½, 4½, 6, and 8-in. sizes. Delivery is approximately two months.

Prodex Corp, Fords, NJ

Coating process developed for aluminum, known as Turcoat 4178, is a surface-conversion type for protection against corrosion, improvement of paint adhesion, and for ornamentation. Material becomes fixed and non-smearing immediately upon application. It is acid-resistant, non-brittle; applied by immersion, spray washer, or hand; provides a thin, smooth, non-crystalline film with slight metallic luster.

Turco Products, Inc, 6135 S Central Ave, Los Angeles 1, Calif



Four-Head Belt Grinder Permits Four Operations at Once

Contact-wheel abrasive-belt machine, permitting four simultaneous grinding operations, is designed for high-volume flat surfacing of ferrous and non-ferrous metals, glass, plastics, ceramics, and other materials. Designated Model 680-4, grinder is said to produce extremely fine mu-in. finishes and to make possible a single-cycle operation from rough casting to polished part.

Typical multiple-grinding sequence, using a series of progressively finer belts, is rough-grind, two semi-finishes, and finish-grind. One pass under the four heads can remove an approximate maximum of 0.020 in. of steel stock, and up to 0.060 in. for other materials. Machine is applicable to both wet- and dry-belt grinding, and has a 100-gal cooling unit.

Machine utilities conveyor belt of 6½ in. by 216 ft size, and belt speeds can be adjusted between 2 and 25 fpm. Abrasive-belt size is 6 x 80 in., with constant speed of 5500 sfpm. Machine has a maximum piece capacity of 5-in.-high and 6-in.-wide work of any length. Heads are powered with either 5- or 7½-hp drives, and machine can be modified for five- and six-head applications.

Engelberg Huller Co, 831 W Fayette St, Syracuse 4, NY

Form Tool Sharpening Gage

Sperco gage for use in both offhand and machine grinding attaches to all circular form tools, threaded or non-threaded, and indicates correct cutting angle automatically. Design holds it in place during setting, grinding, and checking.

Units to fit specifications of any automatic screw machine or turret lathe are available in top rake angles from 0° to 25°. Standard model provides 0°, 5°, and 10° top rake angle.

Sperco Tool Co, Dept F-I, 2318 St Clair Ave, Cleveland 14, Ohio

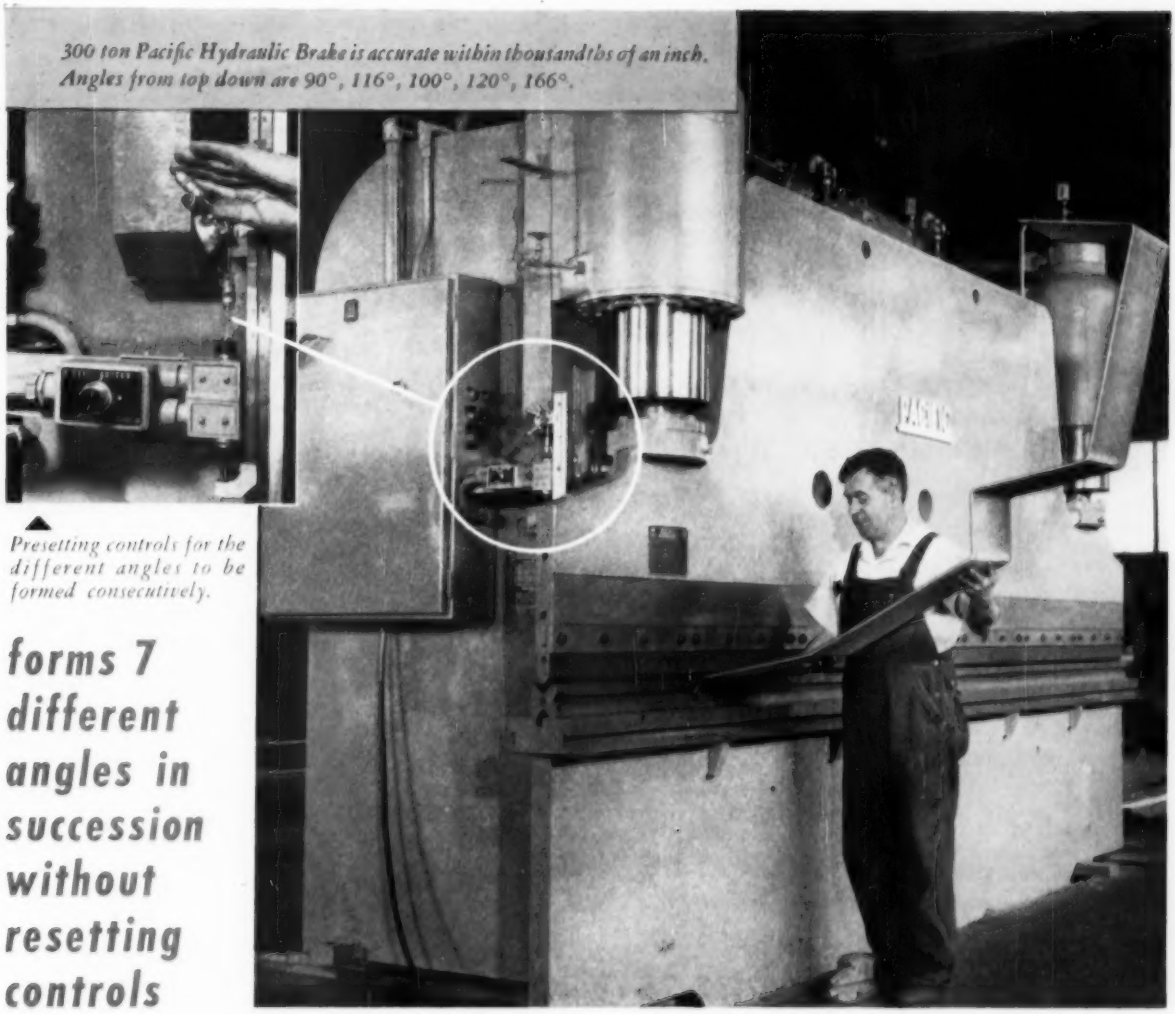
Aluminum Alloy Setup Blocks

Multi-Step blocks are designed to withstand great weight under clamping pressures and to protect fine machine table surfaces.

Units hold work from zero to 3 in. and can be mounted on 3-in.-high Jergens risers, thus pyramided to any desired height. Setup block is positively locked to the riser by means of a male boss and female cavity. Units are packaged in sets of four—two blocks and two risers.

Jergens Tool Specialty Co, 712 E 163rd St, Cleveland 10, Ohio

300 ton Pacific Hydraulic Brake is accurate within thousandths of an inch. Angles from top down are 90°, 116°, 100°, 120°, 166°.



Presetting controls for the different angles to be formed consecutively.

forms 7 different angles in succession without resetting controls

PACIFIC HYDRAULIC PRESS BRAKE

In a single handling of metal, Pacific Hydraulic Press Brake forms an entire series of different bends. You set the controls just once and run through the entire sheet or plate. Handling time is cut to a minimum. Operating on the "air bending" principle, the ram comes down to a different depth with each stroke forming the various angles preset on the controls. Each bend is accurate within thousandths of an inch. The length of stroke can be adjusted to match any job; bends up to 12" deep can be formed in a single stroke while the stroke can be reduced to less than 1/8" and the press will cycle 50 strokes per minute or more.

The ram is held level automatically by patented controls so that work can be done at any point along the entire length of bed. Thus a piece can be passed progressively from die to die for blanking, deep drawing, embossing, punching and forming. In punching, continuous power drives the punch through heavy plate with the shock being absorbed by the hydraulic cushioning of the cylinders. This Pacific Hydraulic Brake is also used for straightening, rubber pad forming, pipe making, stretching, extruding, hot forming and even shearing heavy plates. The Pacific cannot be jammed or overloaded and its precise accuracy is maintained indefinitely. Maintenance is low.

Write for literature

PACIFIC INDUSTRIAL MANUFACTURING COMPANY

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PLANTS: OAKLAND, CALIFORNIA AND MT. CARMEL, ILLINOIS

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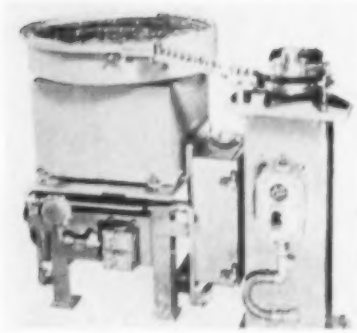


Noblewest Automatic Machine Marks 7500 Metal Parts Per Hour

High-speed production marking equipment consists of a standard Series 20 dial-type marking machine with vibratory parts feeder.

Unit utilizes the roll-marking method for applying a permanent sunk impression into the OD of small round or conical pieces by rotating work between a revolving back-up roll or pressure dial and a concave marking die or type setup. Depth of mark is controlled by spring tension in the die-holder head which maintains uniformity of depth from piece to piece, regardless of slight variations in diameter.

Continuously rotating carrier dial and pressure dial are mounted on a heavy-duty spindle driven by a 1/3 or ½-hp motor through worm gear arrangement mounted in the machine column. Infinitely variable speed adjustment is available so that machine can be set to suit production requirements or to match operator's ability to load in case a hopper feed is not used.

Noble & Westbrook Manufacturing Co, East Hartford, Conn

AUTOMATIC CLUTCH for electric motor applications up to 2 hp utilizes the V-belt pull to increase clutch capacity and provide a speed differential between engagement and release. Speed spreads up to 1000 rpm are available. Type 275 AV has pulley diameter of 2¾ in., is furnished in ½, ⅝, and ¾-in. bore—*Rev-O-Loc Clutch Corp, PO Box 1806, Milwaukee 1, Wis*

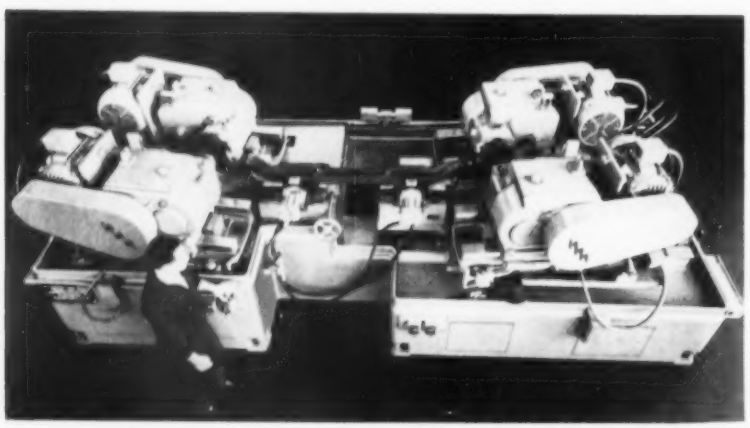
Silicone-Rubber Compounds

Known as Cohrlastic HT 655 and HT 666, silicone-rubber compounds are reported to overcome the major defects of conventional silicone rubber—low tear strength and poor abrasion resistance—but at the same time to possess the basically desirable characteristics of silicone rubber—immunity to ozone deterioration, high- and low-temperature flexibility, and non-stick surface.

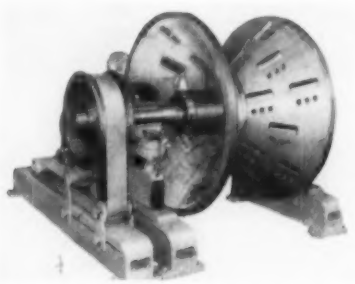
HT 655, a 50 Durometer methyl-base material, is designed for high-temperature work and will remain flexible at -65 F. HT 666, a 60 Durometer methyl-phenyl-base material, has original properties equal or better than those of HT 655 in tear resistance, is slightly lower in tensile strength and elongation. It is said to have outstanding low-temperature flexibility at -100 F.

Compounds owe their greater strength and abrasion resistance to the use of an ester-coated fine silica filler developed by DuPont called Valron. Special inhibitor is used to counteract Valron's tendency to cure too rapidly, a factor which had previously hindered its use as a reinforcing material for silicone rubber.

Connecticut Hard Rubber Co, 407 East St, New Haven 9, Conn



FORGED-STEEL TRUCK AXLES are machined on special unit, in which two pairs of opposed milling heads simultaneously mill the kingpin bosses. Two surfaces on each end of the front axle are face-milled in relation to the frame mounting surfaces. Machine has two tables, each adjustable to permit milling at angles, on each side of the base; milling heads are mounted on each table. Milling quill has 2-in. adjustment, and universal-type fixturing equalizes endwise and provides for variance in part design and size. All machine movements are automatic, except for loading and unloading part. Control and actuation are by hydraulic power—*Motch & Merryweather Machinery Co, Machinery Mfg Div, 888 E 70th St, Cleveland 3, Ohio*



BALANCING MACHINE called Mogul features a pedestal design which permits parts of machine to be placed together or separated, according to the length of the piece to be balanced. Design permits machine to have almost unlimited weight, length, and diameter work capacity. Drive unit may be positioned at either end or in the center. To locate and measure unbalance, unit employs a seismic, free-in-space unbalance indicator attached to work-supporting mountings on chrome balls and raceways which provide over four inches of free amplitude travel. Variable-speed drive enables operator to run machine at low, safe speeds—*Raydyne Corp, 920 W Laurel St, Springfield, Ill*

ANOTHER SCIAKY FIRST . . .

PRECISION CONTROL

for Resistance Welding as accurate as the time signals of the U. S. Naval Observatory

Now, Satisfy Your Most Rigid Production Standards on Long or Short Runs

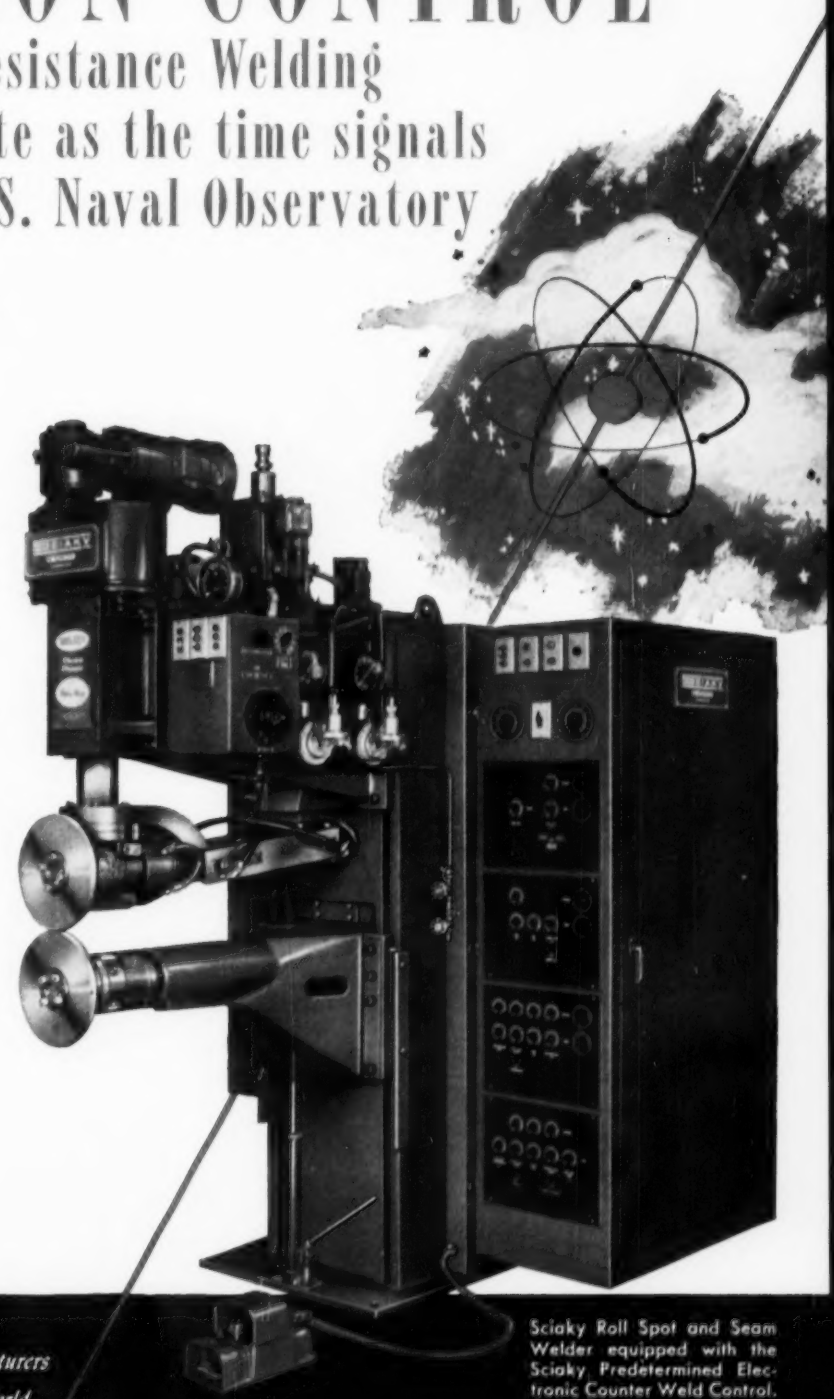
The Sciaky Predetermined Electronic Counter Weld Control employs a Dekatron tube to count the cycles of power line frequency and impulses of secondary current in predetermined absolute numbers and without deviation. Since power line frequency is maintained by reference to Naval Observatory time signals, you get these same standards of accuracy with the new Sciaky Control. Welder functions are *CENTRALIZED* — only one Dekatron tube is used to control succeeding functions such as "squeeze, weld, hold, and off".

The Sciaky Predetermined Electronic Counter Weld Control is absolutely consistent. Positive adjustment snap switch control dials are calibrated in cycles and impulses. You set the number of cycles and impulses you want and you get them throughout the longest or shortest run—and you can easily reproduce them at any time.

Unitized, plug-in sub-assembly units are used to simplify maintenance and make it possible to add welder functions easily. In either case, down time is limited to the few minutes it takes to plug in a spare assembly or the additional units desired.

To find out more about this revolutionary new control ask to see your Sciaky Sales Engineer or write for Bulletins No. 338 and No. 339. There's no obligation.

SCIAKY BROS., INC.,
4933 W. 67th St., Chicago 38, Ill.
POrtsmouth 7-5600



Sciaky Roll Spot and Seam Welder equipped with the Sciaky Predetermined Electronic Counter Weld Control.

Largest Manufacturers of Resistance Welding Machines in the World

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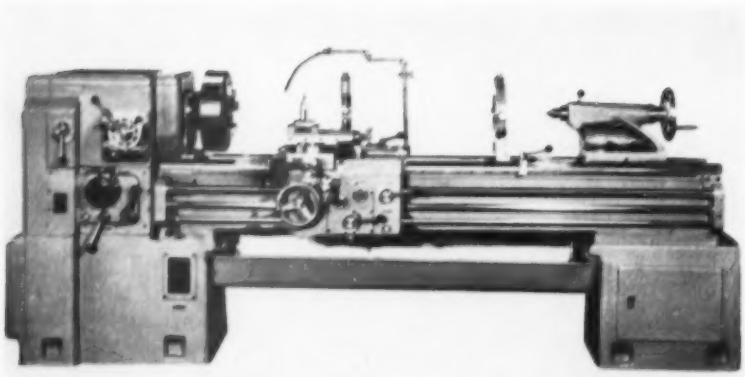


Imperial Gap Lathes Offer Pre-Selection of Spindle Speeds

Type M precision-geared toolroom lathes, made in Italy, provide 18 spindle speeds up to 1310 rpm. Operator can select next speed while machine is operating. Quick-change gearbox has an instantaneous, direct-reading selector. All major units are totally enclosed and pressure lubricated.

Model M-24 has lever for hydraulically controlled spindle-speed changes, plus a hexagon saddle-type turret with automatic power rapid traverse in both directions. Another model M-19, can be fitted with turret at extra cost.

All gears and shafts are made of high-carbon, chrome-nickel steel, hardened and ground. All shafts are supported in ball or roller bearings. Spindle is rigidly mounted on three precision anti-friction bearings with standard Type L-1 tapered key-drive nose. Machines feature flame-hardened beds.

Imported by Aaron Machinery Co, Inc, 45 Crosby St, New York 12, NY

Induction motor, Model 2900, is rated at 1/100 to 1/15 hp, and incorporates an improved 24-slot lamination, compared with 16-slot lamination in older model. Other advantages over superseded model: more power output, cooler running conditions, longer motor life, reduced "cogging" effect, and less external field. Company reports that there is substantially less mechanical vibration and less electrical and mechanical noise. Because of 24-slot design, six- and eight-pole motors are available for more efficient low-speed operation and also for three-phase applications.

Howard Industries, Inc, Dept IM, Racine, Wis

Flame Cut-Off Machine

Production cut-off machine performs straight cut-off and beveling operations on medium- and large-diameter bar stock and pipe. For pipe cutting, torch is mounted radially, and in operation describes a complete revolution about work. For bar-stock cutting, a "secant" action of the torch is used, with the torch head describing only part of a revolution. Built-in safety limit switches stop rotation of the torch head at the completion of the cut.

Pressure piping may be beveled by mounting the torch in an adjustable angle clamp, easily set to the desired bevel angle. To accommodate the full range of pipe-wall thicknesses and bar-stock diameters, torch head is driven by a variable-speed drive mechanism.

Speedi-Burn Products Co, Inc, 534 Linden St, West Hempstead, NY

Electrical Fault Finder

Electrical sentinel developed for the Air Force has been made available for industrial applications. Essentially, the device sets up a comparison circuit for checking against operating electrical or electronic equipment. When this electrical circuit varies from the set standard, the trouble is located. All operation is automatic.

Fault locator can be made an integral part of automatic machinery or may be physically separated from it. It must be specially designed for each operation; company estimates that design and installation require about eight months' work.

Four major sections are included in the prototype of the device: master unit, a number of slave units, bleeder chassis, and connecting cables. Unit uses no vacuum tubes.

Device can check as many as 128 reference points in ten seconds, intermittently or continuously. In operation, locator compares the voltage developed by the test circuit running through the equipment under survey with a standard voltage developed by the slave unit. Comparisons are made in sequence; relays and rotary selectors are used to provide necessary switching.

Commonwealth Engineering Co, Dayton, Ohio

Portable Elevating Table

Models 50-6 (illustrated) and 35 are additions to Portelvator line of elevating tables, have lift capacities of 5000 and 3500 lb. Units are six-wheel models, with two 12-in. roller-bearing wheels occupying center positions and one 6-in. caster under each of the four points of support. Wheel arrangement is said to reduce effort required to push loaded table and to facilitate turning of the table in cramped places.

Lift mechanism has been arranged for side operation, permitting convenient operation when table is loaded with overhanging sheets or bars. Handy tool tray is welded to top surface of bottom plate.

Maker reports that two previously announced models of smaller capacity, Styles A and O, have been redesigned to provide increased capacities.

Hamilton Tool Co, Hamilton, Ohio

There is greater versatility available with Bridgeport MILLERS

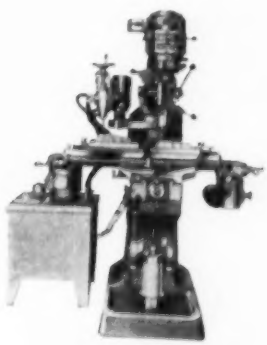
WHEN you buy the BRIDGEPORT TURRET MILLING MACHINE, you buy more than a conventional machine of this type. You actually buy and get a machine in a type which has been conceived, created and developed by Bridgeport. In addition to the turret principle originated by Bridgeport, attachments have been designed which add a great many features to the machine so that its basic purpose for milling, drilling, boring and shaping has been extended to include also cherrying, right angle milling as well as copying with the Bridgeport Hydraulic True Trace Combination.

One of the outstanding advantages of this machine is that you can buy this basic machine with some or all of these attachments or add them later whenever the need arises for the handling of specific operations.

Investigation of BRIDGEPORT TURRET MILLING MACHINES and their many attachments is always in order.

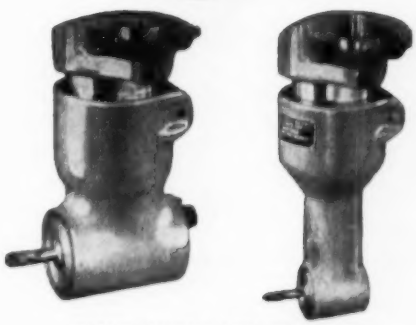
CHERRYING ATTACHMENT

Makes possible production of convex and concave shapes, ideal for producing drop forge dies, molds, cavities.



TRUE TRACE COMBINATION

The Bridgeport True Trace Combination will give excellent performance and save endless hours when copying irregular dies and molds.



RIGHT ANGLE ATTACHMENTS

(Above) Heavy Duty . . . for milling and drilling at right angles; fits both Master and 1 HP Bridgeport Heads.

(Above) Light Duty . . . for right angle milling and drilling narrow, deep molds and cavities.

NO. 2 BORING HEAD

Boring Tools and Holder provide means for boring holes up to 6" diameter; available for use on Bridgeport 1 HP Milling, Drilling and Boring Attachment.

Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS

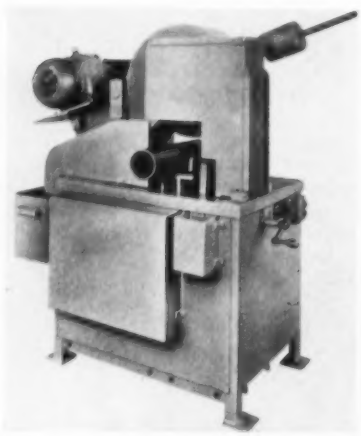
Redesigned Filtration Unit Employs Vacuum Chamber

Vac-40 Vacumatic filter is an improved version of company's Vacumatic filtration unit. Completely automatic and self-cleaning, unit is designed for use on grinders, hones, and other machine tools where continuous filtration of coolants is desired. It employs vacuum rather than gravity, and is capable of delivering high flow rates in sustained operation.

Using a specially fabricated paper as its filtration medium, unit delivers dry sludge with no coolant carry-over. Paper filter medium is supported by an endless fabric belt which in turn is carried on a wire-mesh belt revolving continuously on a chain-sprocket drive. A large vacuum chamber is located under the belt, and the vacuum tends to hold the paper tightly against the supporting screen.

Dirty coolant flows by gravity onto the filter paper, where pressure differential created by vacuum causes coolant to filter through paper into the vacuum chamber. Clean coolant drains into coolant sump and is delivered back to machine by supply pump. When enough sludge collects on paper that suction can no longer be effectively maintained, belt is automatically indexed forward, providing a new filter area.

U S Hoffman Machinery Corp, Industrial Filtration Div, 103 Fourth Ave, New York 3, NY



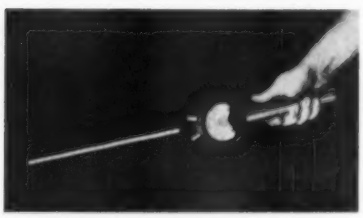
Oscillating Dry-Abrasive Cutter

Model 28 Sever-All has a capacity to handle solid steels up to 4 in. square, 6 in. angles, and 8 in. channels at 90° to axis, using an 18-in.-dia Allison abrasive cutting wheel, a 10-hp motor, and a spindle speed of 2450 rpm. Device is available in both stationary and portable models.

Machine is an oscillating-type unit in which the wheel and work are fed manually. Double-acting workholder automatically positions material being cut in the center of the support, and is clamped at both sides by a hand-operated crank handle.

Forged alloy-steel spindle is dynamically balanced, and each end of spindle housing has labyrinth-sealed-type caps to prevent entrance of dirt and retain lubricant. Front and sides of machine are enclosed by removable steel plates for protection.

American Chain & Cable Co. Inc, 929 Connecticut Ave, Bridgeport 2, Conn



Hand-Held Probe Pyrometer Tests Liquids, Atmospheres

Designed for use in all types of non-corrosive metallic and non-metallic liquids, and in atmospheres of furnaces and high-heat containers, Model 321 pyrometer features lightness and portability. Device has a bright - chrome - plated case and handle which provide an external reflective surface for preventing absorbtion of heat that would normally change the cold-junction temperature.

A calibrating thermometer is built into the unit and is positioned in the immediate vicinity of the cold junction, providing an accurate means of calibration for the cold junction. Thermocouples are refractory bead insulated of the closed-end type.

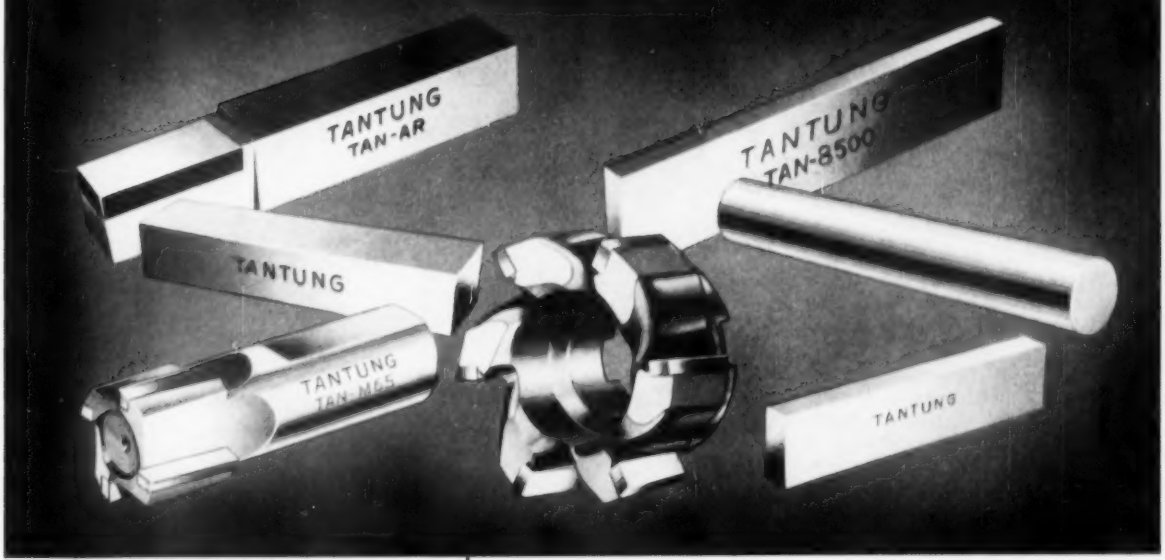
Probe is 19 in. long and comes in two types: chromelalumel couple has range of 2300 F, and the iron constantan couple has a range to 1600 F. Thermocouples may be easily replaced. D'Arsonval Meter movement has a 2 2/3-in. length of scale and an adjustment screw for cold-junction temperature. Device sells for $57.

Pacific Transducer Corp, 11836 W Pico Blvd, Los Angeles 64, Calif

AUTOMOBILE DOOR FRAMES are flash-butt welded on Model BRO-2 air-operated, single-phase machine. Production rate of close to 250 welds per hr is obtained from the 45-75-90° unit, which is rated at 75 kva at 50% duty cycle, has direct-acting rocker-arm clamping system, and is designed for miter joint welding. Two welds are required, each weld in the form of a corner miter joint. Unit has max welding capacity of ½ sq in. of low-carbon steel—*Sciaky Bros, Inc, 4915 W 67th St, Chicago, Ill*

V-R TANTUNG CAST ALLOY

cuts twice as fast as High Speed Steel



Facts You Should Know About TANTUNG, V-R's *Exclusive* Cast Alloy:

- **TANTUNG CONTAINS CARBIDES**—of tungsten, tantalum and columbium. This combination gives it superior toughness and lower friction coefficient than ordinary cast alloys.
- **TANTUNG IS STRONGER**—transverse rupture strength double of most cast alloys.
- **TANTUNG HAS HIGH RED-HARDNESS**—it maintains cutting hardness at red heat temperatures well above that of high speed steel.
- **TANTUNG IS EASY TO GRIND**—aluminum oxide wheels used for hardened steel are suitable.
- **TANTUNG IS AVAILABLE PREFORMED**—when you buy preformed tools, you save grinding costs and get better cutting quality and longer tool life.

When Tooling AUTOMATICS—Don't Overlook TANTUNG!

V-R and TANTUNG are registered trademarks of Vascoloy-Ramet Corporation.

High Red-Hardness — Plus Low Friction

lets you speed up your machines and cut your costs . . .

As a general rule, when using TANTUNG cast alloy cutting tools, you start your machines at about twice the speed you would use with high speed steel tools. TANTUNG bridges the gap between the maximum speeds possible with high speed steel and the minimum speeds practical with cemented carbides. Its general cutting range lies between 80 and 180 surface feet per minute, subject to some variation according to machining operation and material being cut.

And, TANTUNG is at its best under heavy feeds!

Here is a typical example:

JOB: Recessing high alloy steel ring gear forging on Potter and Johnson Semi-Automatic.

	H.S.S.	TANTUNG
Speed:	94 R.P.M.	165 R.P.M.
Feed:	.004"	.008"
Depth of cut:	.125"	.125"
Pieces per grind:	35	70
Av. pieces per shift:	38	100

. . . more than 2½ times production increase!

If you want to reduce costs and increase productivity, take a good look at TANTUNG.

GET ALL THE FACTS in this 24-page *free catalog* containing charts, tables, recommendations and data. Send for yours today.

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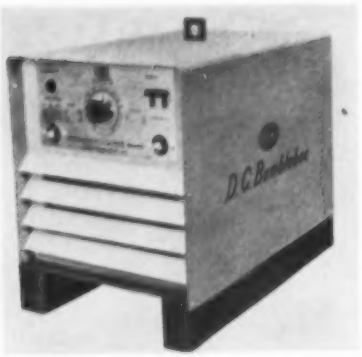
Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

812 S. Market Street • Waukegan, Illinois

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



Arc-Welding Machines Offered in Three Types

Three types of arc-welding machines have recently been added to Airco line:

DC Bumblebee arcwelder (illustrated) has improved selenium rectifiers designed for welding service to convert alternating current to direct current. Unit features a single range of current adjustment, and is available in 200, 300, and 400-amp models. Low design permits stacking for parallel operations.

AC-DC Bumblebee rectifier is designed for metallic arcwelding and will supply ac or dc current by flick of switch. Available in 200, 300, and 400-amp models, with or without power-factor correction, unit has wide welding range and a rheostat which gives micrometer current control within each range of the 3-position switch.

AC-DC Heliwelder machine is available in 200 and 300-amp models, and is designed for use with the various inert-gas arcwelding processes in addition to metallic arcwelding. Machines consist of a single-phase transformer, selenium rectifier, and stabilizing reactor, permitting operator to select either ac or dc current. High frequency, with a rheostat control, is built in, and balancing resistor in series with transformer secondary provides correct current for inert-gas welding.

Air Reduction Sales Co, Div of Air Reduction Co, Inc, 60 E 42nd St, New York 17, NY

Hollow Aluminum Bar Stock

Said to offer all of aluminum's favorable machining characteristics at substantial savings over conventional solid bar stock, hollow aluminum stock is formed from a wrought alloy, No. 6066, developed by company. Stock can be obtained without tooling charges in standard round bar in a range of sizes. Diameters run from 1 through 2½ in. in 1/16-in. increments and from 2⅝ through 3½ in. in ⅛-in. increments. Wall thicknesses vary from 0.109 to 0.500 in.

For most machining applications, weight of the hollow stock averages less than half that of solid bar. Maker also points out that better chip control is also possible; with little metal to hog out, there is a reduction in the amount of chip pulling, handling, and processing.

Stock has the same cold-worked properties on both inside and outside surfaces, so that machining qualities for inside-working tools are superior. Typical yield strength is reported to be 52,000 psi. Cost per foot for 3-in.-OD standard bar with 0.188-in. wall is $2.15.

Harvey Aluminum, 19200 S Western Ave, Torrance, Calif

Electronic Control Provides Variable-Speed DC Motor Drive

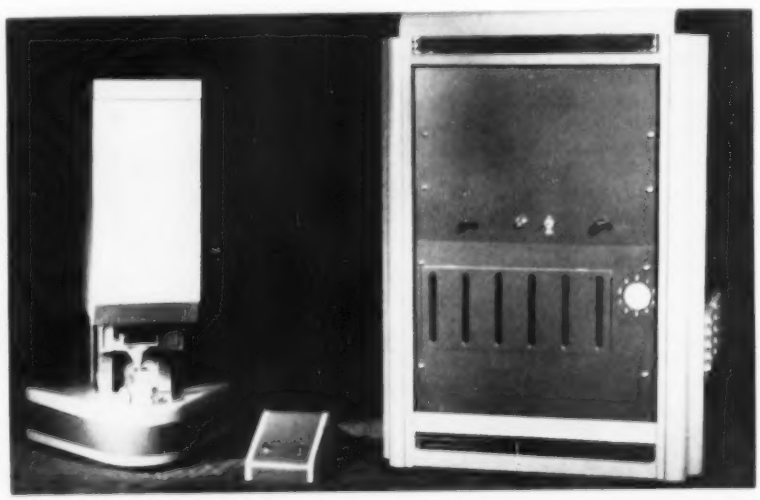
Designed particularly for the precise requirements of variable-speed machine tool drives, electronic control can be preset for specific spindle speeds, or supervised by mechanical or electrical means to provide continuously variable spindle speeds in applications where constant lineal speed is needed at tool tips or grinding face. Maker states that these features make it particularly well-suited for use with grinders, lathes, drill presses, ball mills and other machines with up to 5-hp drive motors.

Control unit provides two full-wave thyratron rectifiers, one to supply and control power for the drive-motor field, the other for similar armature service. Available field voltage and armature current is throttled by voltages taken from the motor field and armature. These voltages are fed to the thyratron grids of the separate rectifier units.

When motor drive is slow, increased field voltage is supplied through the thyratron's increased conductivity, to adjust speed to preset value. At the same time, the other thyratrons permit increased current in the armature. The simultaneous result is maintained speed at high torque.

In instances where preset drive speeds are required, control can be manually adjusted. In progressively changing conditions, such as wearing of grinding wheels, drive-motor speed control can be supervised by signals from auxiliary equipment.

Federal Pacific Electric Co, 50 Paris St, Newark 1, NJ



LINEAR-MEASURING INSTRUMENT called the Fringecount Micrometer is capable of making direct linear measurements to within one-millionth of an inch. Making measurements based on the wave length of light, device incorporates an optical, mechanical, and an electronic system. Illustration shows the three separate units which comprise the system: (left to right) interferometer, which contains the mechanical-optical system; control box, which houses the measuring-head position control switch and zeroing switch; and the fringe counter, which houses the power supply and digital-counter or electronic section. Said to be particularly useful for measuring such items as gage blocks, plug gages, and precision instrument parts, unit has a 2-in. range of movement—*Link Aviation, Inc, Binghamton, NY*

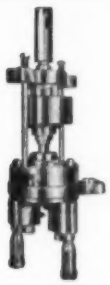
FULLY ADJUSTABLE DRILLING HEAD

Here's a light, compact tool with a wide range of adjustment. Can drill on squares, rectangles, circles, triangles and irregular patterns.

FOR MULTIPLE DRILLING OF HOLES ON PRODUCTION RUNS . . .

ERRINGTON

FIXED CENTER DRILLING HEADS with JIGS and FIXTURES



ADJUSTABLE TAPPING HEAD

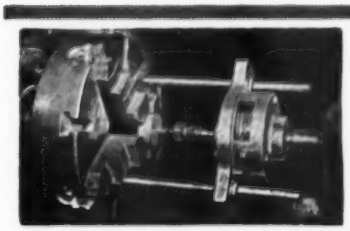
Fully geared. Needle bearings on all spindles in head. Ball thrust bearings throughout. Bronze bushed. Sand cast aluminum case.

ADJUSTABLE DRILLING HEAD

This versatile tool permits you to take advantage of a wide range of adjustment without overhang.

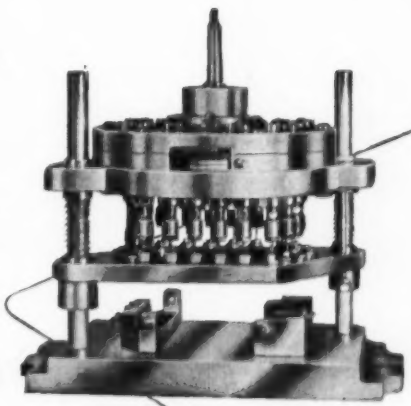
UNIVERSAL JOINT DRILLING HEAD

This dependable tool is adjustable to any pattern of holes. Available with 4 to 12 spindles. All aluminum housing construction, thrust bearings and gears turned on spindles.



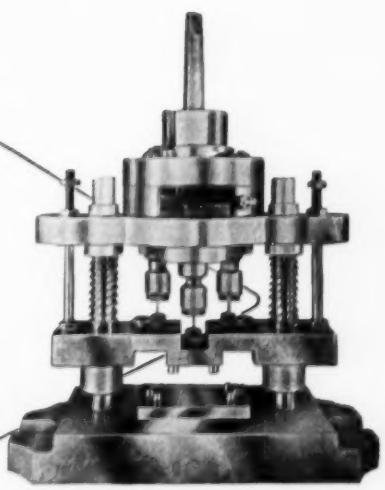
AUTO-REVERSE TURRET LATHE TAPPING HEAD

A new tool, practical, time-saving, money-saving. In a turret lathe setup it allows you to tap the hole and back out the tap without stopping the work or reversing the machine.



Custom Built to Your Specifications. Send Blueprint for Quotation Without Obligation.

Do more . . . and do it better with Errington Fixed Center Drilling Heads. They drill any number of varied size holes on different elevations. The head has grooved thrust ball bearings at all thrust points and hardened bronze radial bearings. Heat treated spindles and gears, of one piece turned from solid bar stock. It is geared approximately 2:1. All enclosed in a sand-cast aluminum case and cover, with alemite pressure lubrication.



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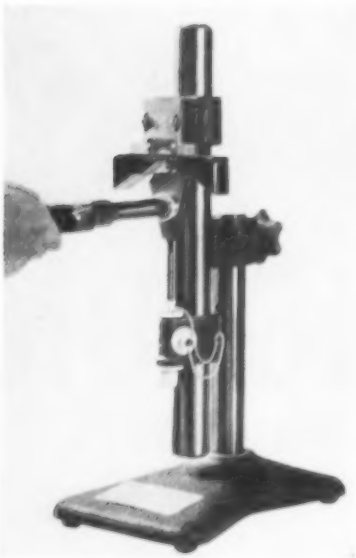


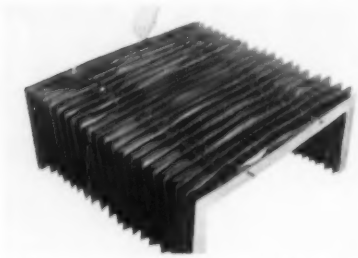
Adjustable Setting Master For Dial Bore Gages

Instrument can be used in place of a number of fixed master ring gages. It is set by means of gage blocks to any desired dimension between 1 and 12⅛ in. and thereafter serves for the initial setting or subsequent reference of a dial bore gage.

Swivelling column locks in either of two positions. While setting the master, weight of the gage blocks must be kept off the adjustable anvil; while setting or checking the dial bore gage, weight of the gage itself must be kept off its movable plunger and centralizers. Thus the master is set with its adjustable anvil uppermost, anvil is clamped in the set position, and column is rotated 180° to bring the centralized yoke on top.

When setting to gage blocks, proper pressure is assured by a ratchet drive similar to those used on micrometers. Setting of the bore gage is facilitated by a guide cap which prevents its lower end from slipping.

Standard Gage Co, Poughkeepsie, NY



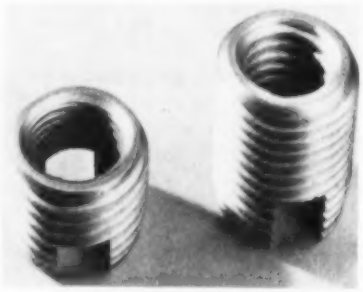
WAY-PROTECTOR for machine tools has 4-in. closed length, opens to 18 in. Neoprene-base material moves back and forth on top-supporting guide rods —*A&A Mfg Co, 2017 W Clybourn St, Milwaukee 3, Wis*

Black Phenolic Molding Compound Has Higher Impact Properties

Improved G-E 12906 has Izod impact range of 0.40 to 0.44. Despite its higher impact properties, compound is said to be suitable for automatic molding processes due to excellent granulation and fast-curing properties.

Additional advantages claimed include uniform pill weight and maximum preformability in tableting machines. Compound reportedly produces molded parts with finish superior to conventional improved impact materials in both cold powder and pre-heat applications.

General Electric Co, Chemical Materials Dept, 1 Plastics Ave, Pittsfield, Mass

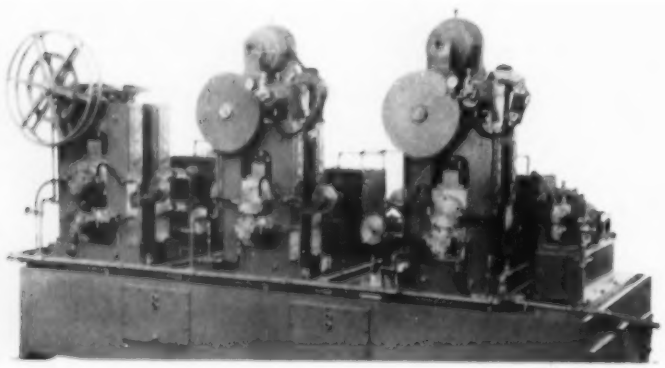


Insert for Thin Boss Materials

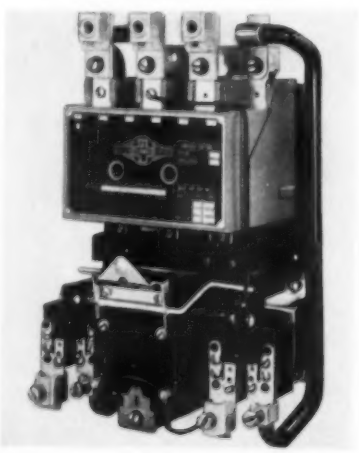
Short Series Tap-Lok insert has been added to the Regular Series for applications where thickness of material prevents use of regular length inserts. Units are used where thread wear conditions exist due to excessive assembly and disassembly in comparatively soft materials.

Inserts can also be used in the slightly harder alloy materials of magnesium and aluminum, permitting thinner bosses and wall thicknesses, thereby decreasing weight while achieving high tensile strength. Series is available in hardened steel, stainless, and brass.

Groov-Pin Corp, Ridgefield, NJ



WIRE-FLATTENING MILL of three-stand tandem type, designated Model No. 082-062-062, has a common base and central coolant and lubrication systems. First mill stand has 8-in.-dia. rolls, second and third have rolls of 6-in. diameter. Unit has synchronized drive to 1000 fpm and features shell rolls for rolling a shape other than square or rectangular, slitter-trimmer, and scrap cutter for continuous processing of wire in 300-lb coils—*Fenn Mfg Co, Newington, Conn*



ELECTRIC MOTOR STARTER, size 4, is rated 50 hp, 220 v, and 100 hp, 440 v. Only slightly larger than size 3, non-current carrying elements are interchangeable with it. Dual voltage coils are reconnectable. (Bulletin 5604) —*Furnas Electric Co, 1044 McKee St, Batavia, Ill*

There's more in this barrel for you...

James P. Gavin, Socony Mobil engineer, (right) helps diagnose lubrication problem on a paper calender.

MORE PRACTICAL EXPERIENCE
to help you improve production and cut costs!

Specify Socony Mobil and you get the benefits of more *practical* lubrication experience than is offered by any other oil company.

Our representatives are long on experience—average well over 15 years of service. In addition, they can make use of our vast store of case histories and technical data amassed since 1866. All this practical knowledge and written experience is available to you to help improve your production and cut your manufacturing costs.

Socony Mobil products are also backed by *more* field engineers serving industry . . . *more* continuous research to assure continually improved products . . . *more* services for analyzing petroleum products in use . . . *more* on-the-job training of your personnel in correct product application . . . *more* approvals from machine builders.

* * *

Always specify Socony Mobil. There's *more* in every barrel for you!

SPECIFY
SOCONY MOBIL

FIRST STEP
IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
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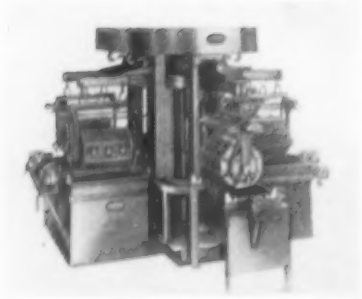


Almco Barrel-Finishers Give Automated Cleaning Cycles

Used in the precision finishing of parts, barrel-finishing systems can perform such operations as descaling, degreasing, grinding, deburring, burnishing, rinsing, and rust inhibiting. Process is automatic from beginning to end, and is controlled by one operator and pre-set switches.

Two types of 10-station machines, called Sub-O-Matic, are available: In-line type is designed for finishing parts of different types which require the same finishes and processes; skip-station type offers automatic programming which permits barrel to by-pass certain stations, so that it is possible to obtain different finishes and processes during the same machine cycle.

Systems employ a power-and-free conveyor system to take barrels into the finishing system. Barrels index simultaneously from one tank to the next by automatic walking beam. After completing the process, barrels enter the unloading station, where parts are separated from finishing media by magnetic separator or vibrating screen. Time cycle for each barrel is 40 minutes.

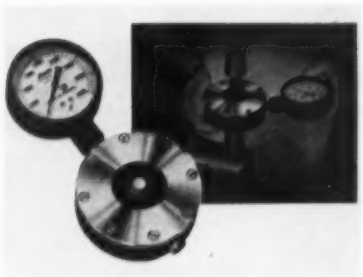
Almco, Div of Queen Stove Works, Inc, Albert Lea, Minn

Research Metallograph

In addition to conventional types of illumination, functions of this unit include low power macro-photography, micro-hardness testing, surface finish testing, and fluorescence microscopy.

Five alternate light sources, including a zirconium and a mercury vapor lamp, are available. All transitions are instantaneous. Viewing screen measures 7 x 7 in.; two cameras for standard 7 x 5 and 4 x 5-in. film or plate are provided. Equipment is mounted on a control desk.

William J Hacker & Co, Inc, 82 Beaver St, New York 5, NY



Direct-Reading Force Gage

Hydraulic-type force gage designed to measure the force between electrodes on spot welding machines, or between rolls on roll welders, also makes compressive tests—useful on forming, dimpling, and upsetting operations — and can be used for weighing. Hydraulic unit features an insulated contact surface, preventing damage from accidental firing of welding equipment while taking force measurements.

Gages are available in five standard capacities: 0-1000, 0-6000, 0-10,000, 0-20,000, and 0-40,000 lb. 3½-in. instruments read directly in pounds, require no conversion charts, and are reported accurate to 1%.

Thickness of units at load point is 1¾ in., body diameter is 4⅝ in., and net weight is 8½ lb.

Webster Instrument, Inc, 11856 Mississippi Ave, Los Angeles 25, Calif

Vibration Isolator Permits Direct Mounting of Machines

SK/50,000 Vibro-Isolator permits direct mounting of heaviest machinery without special chasses or foundations. Unit is rated at 75,000 lb for steady running applications and 50,000 lb for impact applications. Direct mounting of presses and other machines weighing up to 300,000 lb is said to be feasible and economical with only four isolators, and without heavy foundations.

Units consist of heavy-duty welded all-steel housings containing oil-tempered, high carbon, or chrome-vanadium helical steel springs as the isolation medium. Upper and lower members of the housing are held in their relative position against lateral movement by resilient chocks which take up any horizontal thrust, and which can be adjusted for varying degrees of damping to limit vertical and horizontal oscillation under both vibration and impact. Two dual-purpose bolts in top housing secure the mounting to the machine and provide a means for leveling the installation, eliminating need for leveling jacks, shims, or wedges.

Korfund Co, Inc, 48-39B 32nd Pl, Long Island City 1, NY

Small-Shop Air Compressor

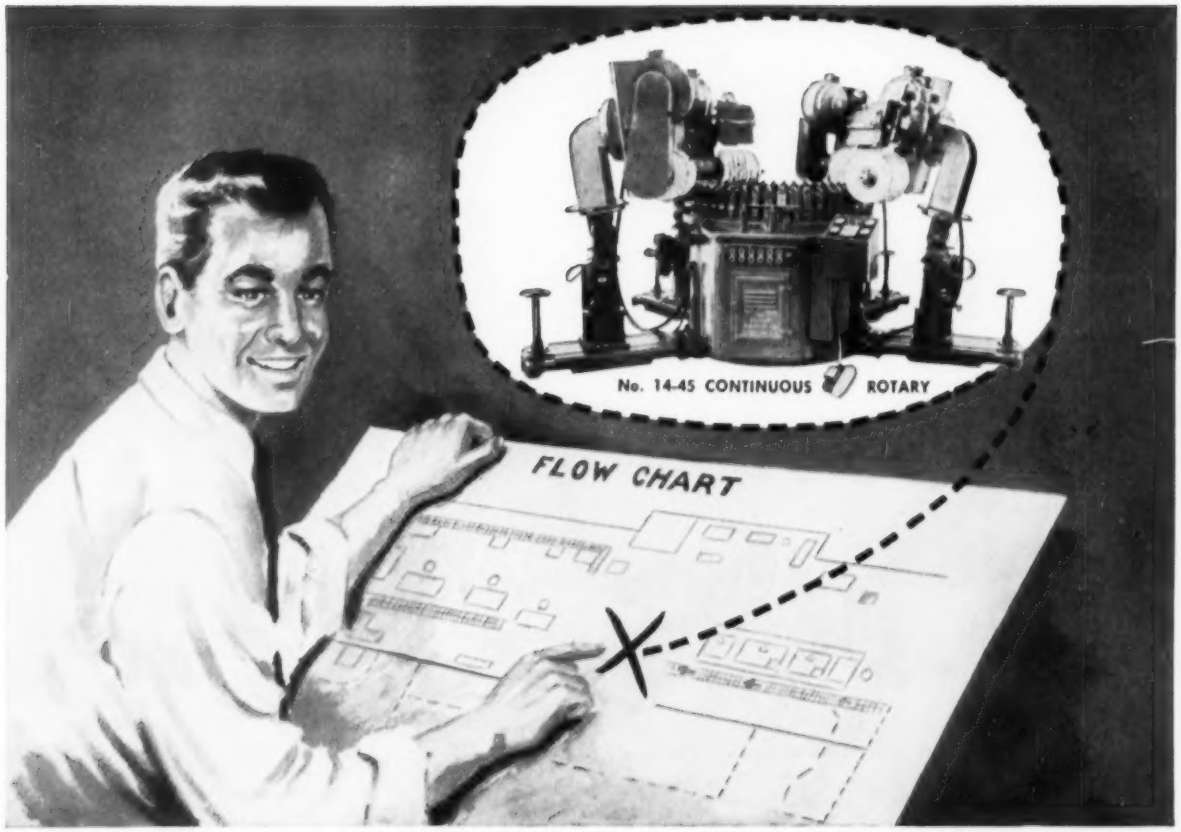
Model UEH-5021 air compressor is designed for small establishments in need of compressed air at a reasonable cost. 1/3-hp unit consists of compressor, electric motor, and air tank, and will operate from ordinary lighting circuit without special wiring.

In operation, compressor is fully automatic, starting when pressure drops to 120 lb and stopping when tank is full at 150 lb. About 26 min are required to fill the 20-gal tank, and time from cut-in to cut-out is approximately 7 min.

DeVilbiss Co, 300 Phillips Ave, Toledo 1, Ohio

Vinyl shop envelopes, designed for high resistance to moisture, acid fumes, oil, are available in all standard sizes, with or without grommet.

Pacific Plastic Products, 6402 Grenshaw Blvd, Los Angeles 43, Calif



PROFIT from *PACKER-MATICS*

When the polishing, buffing or deburring operation becomes a "trouble spot" in your overall production, it may be that your present equipment can't keep up with the accelerated output of other modernized mass production departments.

Packer-Matic automatic polishing and buffing machines are constantly performing production miracles under the handling of semi-skilled operators. Dozens of manufacturers in the automotive, kitchen utensil, electric shaver, plumbing goods, cosmetic, cutlery, and many other fields, are experiencing greatly increased production with Packer-Matics at reduced operating costs.

There are a variety of Packer-Matics with the speed and versatility to meet your most exacting demands for faster, more uniform, low-cost polishing, buffing and deburring production.

Investigate the profit possibilities of Packer-Matics — call or write today!

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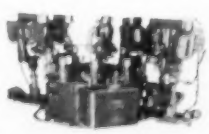
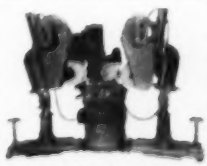
AUTOMATIC MACHINES FOR BUFFING • POLISHING • DEBURRING

THE PACKER MACHINE COMPANY • MERIDEN, CONNECTICUT

No. 4-5 Rotary Indexing


No. 13-10 Rotary Indexing


No. 4-24 Continuous Rotary

No. 1 Straight Line Conveyor

No. 9-4 Rotary Indexing

Built into your equipment

BIJUR

AUTOMATIC LUBRICATION ASSURES SATISFACTION

you benefit 5 ways

- Increase Production Capacity
- Save on Repair Bills
- Eliminate Costly Hand Oiling
- Reduce Downtime
- Lengthen Machine Life

WITH Bijur Automatic Lubrication as an integral part of your machines, you benefit from continuous peak production. Plant after plant reports increased out-put and greatly reduced maintenance costs with Bijur-equipped machines. Costly downtime for lubricating by hand is eliminated. Every bearing is metered the proper quantity of oil at predetermined intervals. Work spoilage and bearing troubles caused by over-lubrication are avoided. Fire hazards are reduced. Personnel accidents are prevented.

More than a million Bijur-protected machines are currently in use. Hundreds of leading manufacturers standardize on Bijur as "built-in" components of their machines. Bijur emphasizes custom engineering, and will gladly cooperate with your machine builder in designing a lubricating system to meet the specific requirements of the machines you order.

Bijur designed into your machines now automatically assures satisfaction. It makes sense . . . and dollars, too! Why not write today for literature and engineering information?

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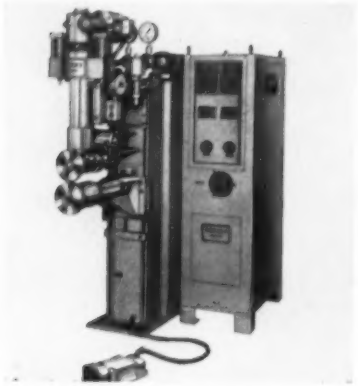
BIJUR
LUBRICATING CORPORATION
Rochelle Park, New Jersey

Pioneers in Automatic Lubrication

NEW SHOP EQUIPMENT

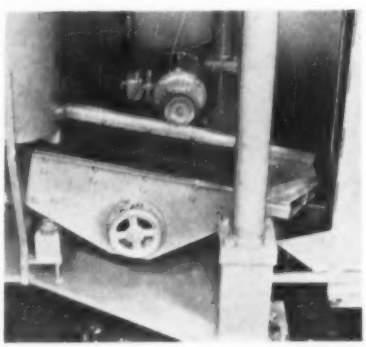


Air-Operated Seam Welder

Designed for production applications, Model MP-1 press-type, single-phase seam welder is one of a series of sizes ranging from 1 through 5. Unit is available in 50- and 75-kva rating at 50% duty cycle. Throat depths range through 24, 30, 36, 42, and 48 in. Maximum electrode force of 1000 lb at 80 psi is available.

Model will weld a wide range of mild and stainless steel. In one application, tubular lengths up to 3 ft of Monel and stainless steel were welded at wheel speeds up to 150 ipm. More information is available from company in Bulletin 316-7.

Sciaky Bros, Inc, 4915 W 67th St, Chicago, Ill



GYRATING FLUX SCREEN, designed to screen flux for automatic submerged welders, removes scrap and fused flux from the usable flux. Good flux is discharged into the boot of a bucket elevator and returned to welding machine. Screens have mechanical action which concentrates vibration on screen deck and transmits little or no vibration to welding machine. Units are available in sizes 10 x 30 in. and 10 x 50 in., and may be designed to fit various types of automatic welders—*Simplicity Engineering Co, Durand, Mich*

"SWITCH!" said Ostuco

. . . and savings were surprising!

Pleasant surprise, too! Bearings Company of America, Division of Federal-Mogul-Bower Bearings, Inc. Lancaster, Pa., was machining OSTUCO seamless tubing to make a clutch release bearing collar used as original and replacement equipment. Results were fine!

Then word came from OSTUCO, recommending a switch to OSTUCO's newly developed NP-60, tubing specially processed for machineability. Cost was slightly higher, but BCA and OSTUCO engineers predicted the savings would justify the change.

they switched . . .

. . . and they SAVED!

	Regular	Specially Processed NP-60
Production per 8 hour shift (units)	675	840
Production time per 1000 units (hours) . . .	12.35	10.03
Total Labor per 1000 units (man-hours) . .	13.09	10.63

Besides the savings, Bearings Company of America was pleased with the better finish of the new part. They point out that the collar in photo above "shows the finish as it comes directly off the machine."

It happens this way often enough to warrant checking with OSTUCO about your tubing applications and production problems. Contact your nearest OSTUCO Sales Engineer or write direct to the Shelby factory —there's no obligation!

OSTUCO SHELBY, OHIO

OSTUCO TUBING

SEAMLESS AND ELECTRIC RESISTANCE WELDED STEEL TUBING—Fabricating and Forging

OHIO SEAMLESS TUBE DIVISION
of Copperweld Steel Company • **SHELBY, OHIO**
Birthplace of the Seamless Steel Tube Industry in America

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CANADA, RAILWAY & POWER ENGR. CORP., LTD.
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Family Portrait of

PRATT & WHITNEY

Solid Carbide Cutting Tools

but here's what the camera DIDN'T *catch*

It couldn't possibly picture all the many types and sizes of cutting tools in the very complete P&W Solid Carbide line . . . that would take a whole family photograph album. And the photograph doesn't show the years of cutting tool know-how, experience and carbide research that goes into every P&W Carbide Tool (even though it *is* easy to see how this extra quality will save money on your production lines). Out of camera range, too, was one of the most important features of all – the way P&W Engineering Service makes sure that every P&W Carbide Tool you buy is exactly right for *your* specific job requirements. If one picture's worth a thousand words, we believe that one sample of the way P&W Carbide Tools perform on the job is worth a thousand pictures . . . so ask a P&W Cutting Tool Representative to *show* you.

PRATT & WHITNEY COMPANY
INCORPORATED

11 Charter Oak Boulevard, West Hartford 1, Connecticut

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MACHINE TOOLS • GAGES • CUTTING TOOLS

NEW SHOP EQUIPMENT

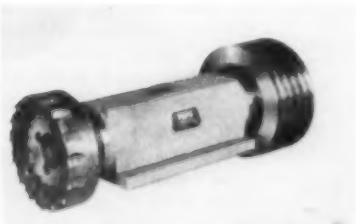
Inserts for Plastic Molding

Threaded inserts for plastics, rubber, die castings, and potting compounds are designed to be molded directly into the product, require no secondary operations for inserting or locking.

Units are knurled to prevent rotation; additional strength against pull-out is obtained by two circular relief bands. Two series are available, tapped straight through, and blind. Inserts are furnished in sizes from No. 2 to ⅜ in. in all regular thread sizes, both NC and NF.

Standard Insert Co, 12270 Montague St, Pacoima, Calif

AUTOMATIC SCRAP-METAL BALER called Scrap-O-Matic is a hydraulic machine capable of baling 100 lb of metal into a 1-cu-ft briquette. Occupying 12 x 3½ ft of floor space, machine weighs 4000 lb and requires no pit or anchoring. One man can operate the machine—*East Chicago Machine Tool Corp, East Chicago, Ind*



Heavy-Duty Milling Spindles

Line of belt-driven milling spindles in 12,000 series is available in a range of sizes from 1 to 50 hp, with standard No. 10, 20, 30, 40, 50, or 60 milling-machine noses.

Units are equipped with two large

"RODGERS PLATEN PRESS GIVES US

FAST CYCLING WITH COMPLETE SAFETY"

—SAYS VEIT AND YOUNG

Rodgers 400-ton platen press in use at Veit and Young, Huntingdon Valley, Pa., metalworking specialists. The press is equipped with die cushion, fast cycling cylinders and other accessories. Some of the products formed are stacked by the press.

Higher, more consistent press cycling rates are maintained by Veit and Young press operators with the safety controls used on their Rodgers Platen Press. Complete operator-confidence in these safety controls means they can concentrate on speed and accuracy! At Veit and Young's Huntingdon Valley, Pa., plant they're working with type 303 stainless steel, brass, carbon steel and aluminum. Stock thicknesses range from $\frac{1}{32}$" to $\frac{1}{8}$" with bends up to 90°. Production has increased in the drawing and forming of large serving trays and electrical panels.

Fast cycling of this Rodgers Platen Press is made possible by auxiliary cylinders. They lower the big platen quickly to the die contact—raise it equally fast after die disengagement. Forming pressures can be pre-set from 80 to 400 tons. Holding pressures on the pneumatic die cushion range up to 50 tons! Veit and Young changes dies in an hour or less.

Rodgers Electro-Hydraulic Control System governs all platen, pressure and time cycles with simple, fast adjustments—for increased output! If you work in metal, plastics, rubber, veneers,—you can mold—draw—form *faster* with a Rodgers Platen Press. Capacities 10 to 600 tons, with plain or heated platen, up or down action, controls and accessories to suit your needs. Tell us your production requirements and send for Rodgers "Blue Ribbon" Platen Press Catalog.

HI-PRESSURE Rodgers HYDRAULICS

Rodgers Hydraulic Inc.

7407 WALKER STREET • MINNEAPOLIS 26, MINN.

STERLING SPEED-TROL VARIABLE SPEED MOTORS

STERLING SLO-SPEED GEAR MOTORS

STERLING CONSTANT NORMAL SPEED MOTORS

STERLING MULTI-MOUNT SPEED REDUCERS

Let Sterling Electric Power Drive Engineers assist you in the selection of power transmission equipment and controls precisely co-ordinated with your machinery, product and production volume to help you achieve greater productivity. Sterling Drives correctly matched to specific job requirements can simplify cost reduction and improve your competitive position. Thousands of leading companies are profiting daily through installation of correctly engineered Sterling Electric Power Drive systems.

Write for Bulletin No. 185. Discover the big advantages Sterling Electric Power Drives can bring to your plant.

Sterling offers you a wide range of Electric Power Drives of advanced design—variable speed or constant speed—with manual or automatic controls.

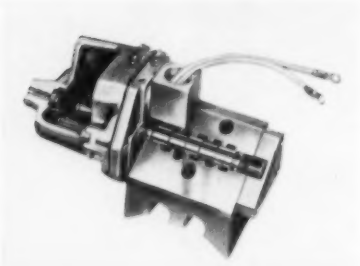
STERLING ELECTRIC MOTORS

Los Angeles 22 • Chicago 35 • Cincinnati 37 • New York 51

cylindrical roller bearings which carry the radial loads. Bores are tapered, as are the spindle shafts, so that bearings may be individually preloaded. Precision thrust bearings are likewise permanently preloaded to stabilize the shaft axially against endwise movement in either direction. Lubrication system is permanent, and spindles are said to run at low temeprature.

Units may be arranged to operate in any position user specifies. They are also available with enclosed, fan-cooled motor drives from 1 to 100 hp. Bulletin S-8.

Pope Machinery Corp, 261 River St, Haverhill, Mass



MULTI-PURPOSE VALVE called Comet II (shown in cutaway view) can be adapted to power a wide range of air- and oil-powered devices, such as a welding gun, transfer mechanism, or air riveter. Unit completes a valve cycle within 0.033 sec, and is engineered to tolerances of 0.0001 in. Model is available with ¼ or ⅜-in. pipe tap for in-line use, and in single-solenoid spring return, double-solenoid momentary, and double-solenoid three-position types. Valve measures only 7¼ by 3½ by 3⅞ in., and flow capacity is equal to that of a ¼-in.-dia hole—*Ross Operating Valve Co, Detroit, Mich*

Automatic Drilling Unit

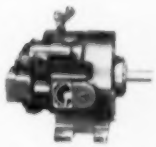
Model 113 is a complete drilling unit with electric-motor-driven spindle and hydraulically controlled, air-operated quill feed. Spindle feed and

What's New in VICKERS HYDRAULICS

Illustrated here are new and recently improved units added to Vickers most complete line of oil hydraulic equipment. Look to Vickers as a single responsible source for integrated hydraulic systems. For characteristics of any of these components, please write for Installation Drawings by number.

SERIES T8 PIPELESS POWER PACKAGE consists basically of electric motor, hydraulic pump, control circuit and reservoir. Available in 3 circuits, 3 pump sizes and 3 electric motor sizes. Inst. Dwgs. 178706, 7 & 8.

V-LINE PISTON PUMPS AND MOTORS for 5000 psi. Unique design minimizes relative movement between rotating parts, provides increased bearing surfaces and reduces complexity of parts. Result is improved efficiency, longer life, and reduced maintenance. Supplied with straight thread connections. Bulletin 55-72.



Variable Displacement Pump With Servo Control. Inst. Dwg. 179061. Also available with pressure compensator control. Inst. Dwg. 179060.

Constant Displacement Fluid Motor. Inst. Dwg. 179059. Available also is a Constant Displacement Piston Pump. Inst. Dwg. 179058.

DG4S4 ⅛" solenoid operated. Inst. Dwg. 182412. ¼" available later.

DG5S4 ¾" solenoid controlled pilot operated. Inst. Dwg. 182413. 1¼", 2", 3" available later.

SOLENOID OPERATED 2- AND 4-WAY VALVES with many improved features. (1) Integral junction box (2) covers that retain the solenoids and (3) manual operation for testing. Compact and versatile. Gasket mounting simplifies installation and overhaul . . . also minimizes piping.

TRAVERSE AND FEED CYCLE CONTROL PANEL Improved design. Provides any cycle sequence of rapid advance, adjustable feed, dwell and rapid return motions. Maintains smooth and constant preset feed rate (either one or two) regardless of fluctuations in cutting tool resistance or hydraulic pressure.

CPP-2242 Solenoid Controlled, Pilot Operated (gasket mounted) provides smooth, low current operation. Inst. Dwg. 182414.

CG-03 Relief Valve (gasket mounted). Subplates available with pipe or straight thread connections. Inst. Dwg. 175630. CS-03 available with straight thread connections. Inst. Dwg. 175629.

C02 Reciprocating Cycle Control Panel For Gasket Mounting. Inst. Dwg. 177083.

4CG-03 Pilot Operated Check Valve, gasket mounted. Inst. Dwg. 135468.

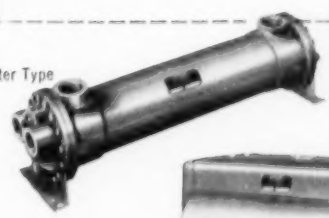
CG-714 Deceleration Valve, gasket mounted. Inst. Dwg. 172902.

CGV-06 5000 psi Relief Valve gasket mounted with straight thread connections. Inst. Dwg. 177609.

URG1 Unloading Relief Valve, gasket mounted. Inst. Dwg. 178974.

SG1 Pressure Switch, gasket mounted. Inst. Dwg. 172538.

Water Type



OIL COOLERS Vickers Oil Coolers are characterized by their very high rate of heat transfer per unit of space occupied. Bulletin 55-69.

Air Type

For further information on any unit shown, ask for Installation Drawing by number indicated. 7435

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
ADMINISTRATIVE and ENGINEERING CENTER
Department 1410 • Detroit 32, Michigan

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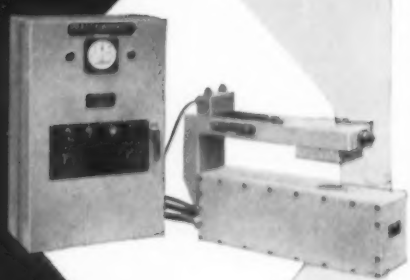
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Only PRATT & WHITNEY

manufactures all the types of GAGES and AUTOMATIC CONTROLS for the Steel Industry

AUTOMATIC SCREWDOWN CONTROLS

. . . provide fully automatic control of strip thickness. Now on the job in more than 25 mill installations.



BETA RAY GAGES

. . . Without touching the material, these gages continuously indicate and record thickness or weight deviations in strip or sheet steel, tin plate, brass, aluminum, etc.

X-RAY GAGES

. . . Simple to install and maintain. Stability is excellent, unaffected by voltage fluctuations. Compensated for alloys. Used to gage a wide variety of sheet and strip materials.

CONTACT GAGES

. . . Model D Continuous Gages coupled with P&W Automatic Controls can be arranged to operate warning lights, audible signals and shut-off devices, as well as automatic controls.

AUTOMATIC TENSION and SPEED CONTROLS

. . . provide continuous and complete feed-back control for applications where a vernier on the screwdown is required.

Write for gage literature.

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KEEP QUALITY UNDER CONTROL WITH PRATT & WHITNEY CONTINUOUS GAGES AND AUTOMATIC CONTROLS

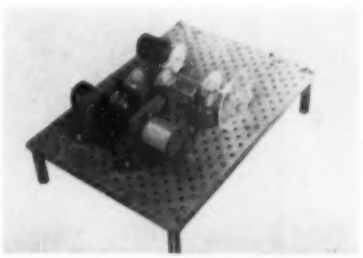
MACHINE TOOLS • GAGES • CUTTING TOOLS

speed are under separate control for any combination of feed to speed.

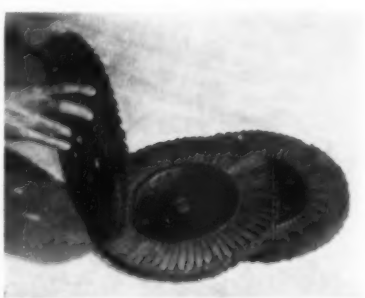
Spindle travel is powered by an in-line double-acting air cylinder. Feed rate is controlled by a closed hydraulic system. An induction-type motor with timing belts provides speeds from 865 to 13,800 rpm.

Other specifications: drilling capacity, No. 60 to ¼ in.; quill stroke, 1½ in.; air required, 40 to 80 psi.

Electro-Mechano Co, 261 E Erie St, Milwaukee, Wis



BREADBOARD DEVELOPMENT KIT called Servoboard has been redesigned to add new components. Holes in the mounted board are tapped, and the hanger-mounting clamp is a one-piece unit with a captive screw. To save space, board and leg design has been changed to allow stacking several boards. Maker offers a wide range of electrical and mechanical components, and all parts may be purchased individually or as kits. Catalog No. TDS1110— *Servo Corp of America, 20-20 Jericho Turnpike, New Hyde Park, LI, NY*



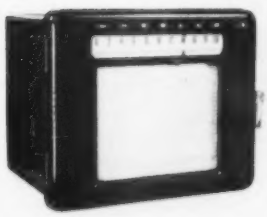
Sectional Impregnated Abrasive Buff

For buffing all ferrous and non-ferrous metals, pleated-type sectional abrasive buff is made of specially treated biased cloth which has been impregnated with abrasive grains throughout. Both fine and coarse grits are available.

Buffs can be altered by the use of conventional spacers to adjust cut-

ting action and to provide greater coverage. Applications requiring widths up to 50 in. can be accommodated. Normal side supports and flanges can be used.

Carborundum Co, Niagara Falls, NY



Electronic Potentiometer-Recorder Self-contained and requiring only an external sensing device, Series 8000 electronic potentiometer-recorder is available in a wide range of models which measure, indicate, control, and give a permanent record of such variables as temperature, speed, strain, hydrogen ion, and other quantities that can be resolved into electrical signals.

Maker reports that the following applications can be particularly well served by the instrument: measurement and control of temperatures in the pyrometric range; resistance-thermometer use; speed measurement; radiation receiver (pyrometer) use; measurement of pressures through use of a strain gage.

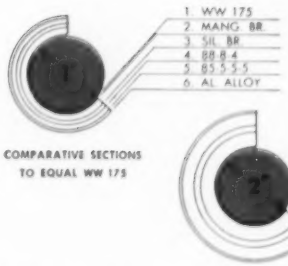
Both chart rolls and the chart and recorder drive assembly swing out 180° for accessibility. Instrument is available in a wide selection of standard range scales which can be changed without a soldering iron or the necessity to change the slide-wire.

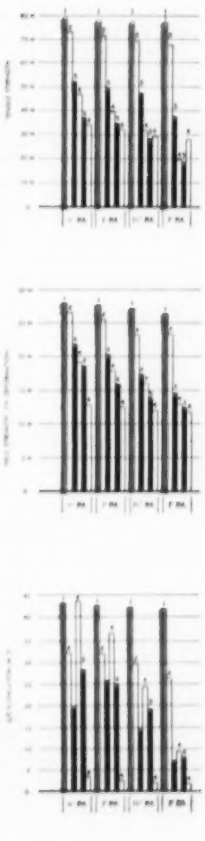
Wheelco Instruments Div, Barber-Colman Co, Rockford, Ill

Plastic Tu-Bend dies are available for bending metal tubing. Complex forming in multiple planes, including short radius bends, is possible with the new stamping process. Dies may be used with any conventional stamping or forming press for high or low production runs. Lever or cam-action hand presses may be used for limited quantity production or for forming prototype tube parts.

Warren Plastics & Engineering Co, 27500 Groesbeck Highway, Roseville, Mich.

and put the SURPLUS in your pocket





The two diagrams above show relative sections cast nonferrous alloys required to *equal* the tensile strength of 1" and 2" dia. WW 175 Aluminum Bronze. Note how tensile strengths fall off as sections increase—except when you design with WW 175, the *constant* alloy! The comparison becomes even more dramatic when you study the bar charts showing tensile and yield strengths and elongation. Regardless of section required, WW 175 retains these mechanical values with only a minor decrease.

What does this mean? You can design smaller sections requiring less metal (a saving even when WW 175 is compared to many cheaper alloys), you reduce the mass, you save weight—so you cut the cost of your product while improving its performance. Don't forget, too, that WW 175 at .274 per cu. in. weighs substantially less than most competitive bronze alloys.

Want to know more about the big family of WW Aluminum Bronze Alloys? Our new catalog gives full details, specifications, properties, applications of 16 types, comparative specs, machining recommendations and information on our foundry and production facilities. Write for No. 15,100-1 and name of our representative in your area.

WW ALLOYS, INC.
11652 CLOVERDALE AVE.
DETROIT 4, MICHIGAN
Division of Fansteel Metallurgical Corporation

MACHINABILITY INDEX 80-90*

PEARLITIC MALLEABLE CASTINGS

* B1112 STEEL = 100

Low machinability index of 80-90 (B1112 steel = 100) is probably reason enough to warrant serious consideration for your product.

But pearlitic malleable castings—from National—don't stop there. They have great ultimate strength . . . resist wear under heavy loads at high speeds . . . make excellent non-seizing bearings . . . can be air or liquid-quenched . . . can be smooth-finished.

Don't overlook the advantages of pearlitic malleable. For pearlitic malleable castings—from National—can often reduce manufacturing costs, weight and assembly time . . . can increase the sales potential of your product. AA-1906

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

Cleveland 6, Ohio

The Nation's largest independent producer of malleable and pearlitic malleable

NEW SHOP EQUIPMENT

Consumable solid-insert rings for use in inert-gas, tungsten-arc welding of piping are produced for all standard or special pipes and tubes of 1½-in. diameter or larger, in several types of materials. Maker claims following advantages: welding without backing rings, smooth root-pass welds with elimination of root-pass cracking, and improved weld contours in thin-wall piping with one or two fewer passes.

Grinnell Co, Inc, Industrial Piping Div, Providence, RI

Socket wrench for production line torque control problems permits a maximum torque variation of only ± 2% under operating conditions. When proper torque has been applied, wrench releases automatically and allows a few degrees of free rotation. Jotru 25, a 10-in. model, has a drive size of ⅜ in., affords range setting of 5 to 25 ft lb. Jotru 500, 36 in. long, has drive size of ¾ in., range of 200 to 500 ft lb.

Jo-Line Tools, Inc, 8442 Otis St, South Gate, Calif

Vapor Degreaser Incorporates Automatic Cool Dip Rinse

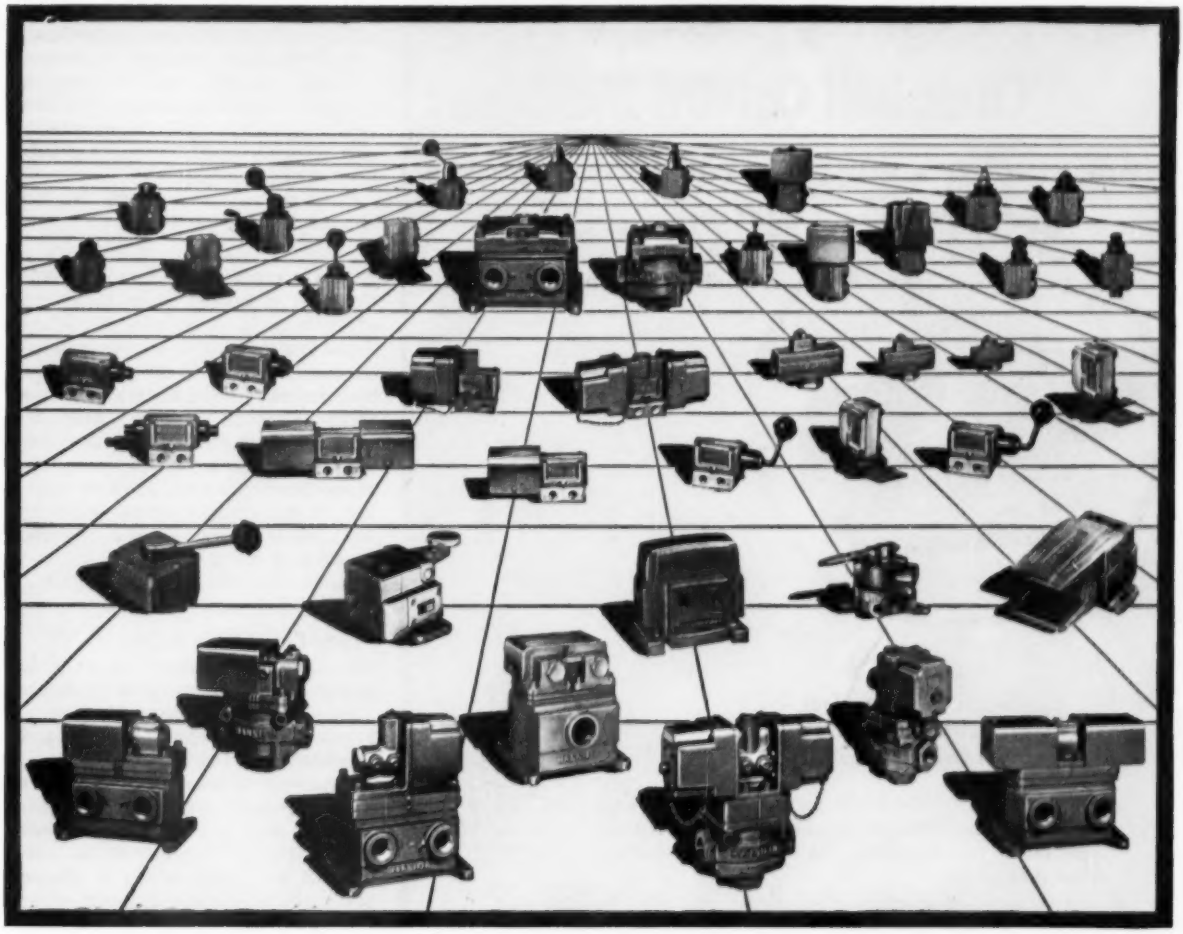
Unit operates on Phillips' rotomatic principle which permits a pre-determined and accurately controlled degreasing time cycle; rinse washes off chips and other insolubles.

Baskets are used where work is relatively free from recesses or a tendency toward nesting; if such conconditions exist, unit is available with tumblers to provide thorough cleaning action. Time cycles are completely adjustable. Units range in size from 1800 to 4000 lb per hr and are furnished in electrically heated, steam, or gas-heated models.

Phillips Manufacturing Co, 3427 W Toughy Ave, Chicago 45, Ill

Miniature speed-control device called Syncro-Snap measures only 1-1/16 in. in diameter, is based on same principles as company's older centrifugal switches. Features include instantaneous snap action, accuracy to 0.25%, and a unifrom operation life of up to 1,500,000 operations or higher. Switch requires a rapidly decreasing rate of pressure to hold it in operating position as the predetermined speed is approached; this feature, combined with the rapidly increasing centrifugal force, results in a positive snap action and fast opening or closing of the stationary switch contact points. Tendency to

FOR AIR CYLINDER CONTROL... Manual or Electric



Hannifin is your best valve source

What air control valves do you need, or prefer? Hannifin has all types—for your production lines or the machines you manufacture. They include:

P-M Pilot-Master Valves, solenoid controlled by integral pilot heads (including new-type, dust-tight, splashproof heads that completely meet J.I.C. recommendations). ⅜" to 1¼". 2-way, 3-way and 4-way.

P-M Master Valves. ⅜" to 1¼". 2-way, 3-way and 4-way, air operated. For remote control from a wide choice of P-M Pilot Valves.

P-M Direct-Operated Valves. For direct control of small air cylinders. 2-way, 3-way and 4-way. ¼" and ⅛".

Disc Valves. Rotary and sliding reciprocating disc types for hand, foot or electric operation. ⅛" to ¼".

Micrometric Speed Control Valves for micrometer-like speed adjustment through control of exhaust flow.

You can simplify your air control problems by standardizing on Hannifin.

Stock Delivery On All Types

HANNIFIN

MAIL THE COUPON FOR PROMPT ACTION

- ☐ Have Field Engineer call at once
- ☐ Have Field Engineer stop by soon
- ☐ For the present, just send complete Hannifin Control Valves Catalog

Hannifin Corporation, 517 S. Wolf Rd., Des Plaines, Illinois

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Company.....

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City.....*Zone*.....*State*.....

Abrasive Cutting

the best way to cut many materials
the only way to cut some

Campbell Cut-Off Machines

WHAT KIND OF A CUT DOES YOUR JOB REQUIRE?

THIS Clean, smooth edges that require no further finishing
or THIS
Rough, serrated edges that must be machined if smooth finish is required

The smooth cut—made on a CAMPBELL Oscillating Wet Abrasive Cut-Off Machine and the just-right ALLISON Abrasive Wheel for the job—saves a grinding operation at a Midwest gear plant.

Another combination of CAMPBELL Cut-Off Machine and ALLISON Wheel cuts stainless steel tube twice as fast as by other methods for a large aircraft manufacturer.

Can you cut tough K Monel, 4¾" dia., in two minutes per cut by present methods? Whatever your problem, our abrasive cutting specialists can improve your cutting operation and save you money.

OSCILLATION makes these big cuts with speed and economy

The cross section of gear teeth (*shown left above*) is cut smooth, fine-finished and ready for metallurgical study.

It results from the wet cut of an Oscillating CAMPBELL Abrasive Cut-Off Machine with abundant coolant applied just where it does the most good. The Oscillation of the ALLISON Abrasive Wheel, the right one for the job, handles big cuts like this with speed and economy.

If your cutting involves alloy or high carbon steel, this CAMPBELL-ALLISON combination just can't be beat.

Let us send you this book

ACCO

Campbell Machine Division
AMERICAN CHAIN & CABLE

923 Connecticut Avenue • Bridgeport 2, Connecticut

flutter or chatter is reportedly eliminated. Device is intended to protect electronic computing equipment against overheating because of slowdown or failure of cooling system, and is mounted on the output side of the blower motor shaft.

Torq Engineered Products, Inc, Interstate St, Bedford, Ohio

Socket wrench hinge handle, Proto No. 5457 Rotahead, does the work of both a ½-in. square drive reversible ratchet and a conventional hinge handle. Self-contained head mechanism provides free-wheeling action. Pressing down on head allows handle to rotate freely in either direction; release of pressure engages drive plug for positive turning of a socket wrench. With 30 teeth on inner wheel, new bite can be secured every 12°.

Plomb Tool Co, Los Angeles, Calif

Power-Conversion Units

Extended line of selenium ac-to-dc power-conversion units is available with single-unit ratings to 125 kw. Previous units began at 0.75 kw and extended only to 25 kw.

Company points out that larger blocks of power incorporated in single units save both money and floor space. Unit ratings are 50, 75, 100, and 125 kw. Each rating is offered in either 125 or 150-v dc, with other voltage ratings available on special order.

Installation requires no special foundations. Construction features include GE Vac-u-Sel rectifier stacks and the absence of moving parts, except for ball bearings in the cooling fans.

Rectifier Dept, General Electric Co, Lynn, Mass

Slip Roll Forming Machines

Modified models of Niagara slip roll forming machines have been equipped for the forming of "obround" and rectangular shapes. Both power- and hand-operated machines can be equipped with this feature.

With this optional equipment, machines alternately produce curved and flat surfaces for high production of obround tanks and containers, round-cornered rectangular pipe sections, and similar objects.

On the 6-in.-dia machine, rear roll is positioned pneumatically between two limits to form curves and flats alternately. On smaller machines, rear-roll action is mechanical. Only

a simple sheet, with markings where curves begin and end, is required as a guide. Flat surfaces are "feathered" into curves by the continuous rotation of the rolls during radius changes. Bulletin 77.

Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY

Thread-rolling attachments offered in three models have one roll in fixed position in relation to work spindle, adjustable opposite roll. Model BB will roll over 70 different threads from ¼ to 1-in. diameter. Model CB will roll 63 threads within diameter range of 6/32 to ⅝ in., Model DB 53 threads ranging from ⅞ to 1¼. All models are designed for installation on all types of automatic screw machines, can be equipped with company's hydraulically actuated cross-slide where it is required.

Salvo Tool & Engineering Co, 26441 Gratiot Ave, Roseville, Mich

Polyester insulator, designated 504, for traveling crane trolley feeder conductors, is designed for service up to 1000 volts. It is 1⅜ in. in dia, 2¼ in. long, yet is said to be rugged enough for heavy-duty installations.

Red Seal Electric Co, 6321 Detroit Ave, Cleveland 2, Ohio

Plastic gear reducer, Model SW-1 for use with fractional-hp motors, has polyester fiberglass case, nylon gear, and steel worm. Unit is available in seven sizes with speed reductions ranging from 5¼ to 1 to 60 to 1.

Rampe Manufacturing Co, 14915 Woodworth Ave, Cleveland 10, Ohio

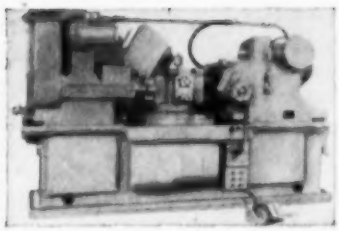
Self-priming hand pump, positive-displacement piston-type, delivers 20 gpm. Unit is available as pump only, barrel pump, pedestal pump, or with hose and nozzle delivery; handles solvents, lubes, cutting or paint oils, soaps, waxes, and maintenance liquids. Bulletin 3011.

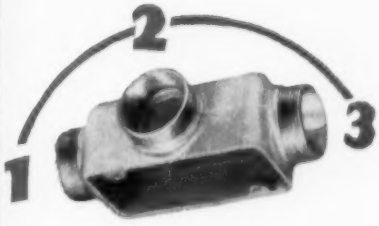
Bowser, Inc, 1300 E Creighton Ave, Fort Wayne, Ind

Vitrified grinding wheel, specially designed for cylindrical grinding on cam shafts, other center-held grinding operations, and tool grinding, is said to give more pieces per dress. Furnished in sizes from tiny internal wheels to 36-in. cam shaft units.

Electro Refractories & Abrasives Corp, Buffalo, NY

Here's what is meant by "1·2·3" in the GOSS & DE LEEUW AUTOMATIC CHUCKING MACHINE





The outstanding advantage of this machine is ability to handle operations on one, two or three ends of a piece simultaneously or in sequence, *without changing set-up or rehandling.* It is the only standard machine that will do this.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence—a method exclusive with Goss & DeLeeuw and offered on this machine.

For complete details ask for illustrated bulletin. Send samples of your work for time and cost estimates.

GOSS & DELEEUW
QUALITY PRODUCT-QUANTITY

GOSS *and* DE LEEUW
MACHINE COMPANY, *KENSINGTON, CONN., U.S.A.*

How would you jig and set up to perform nine operations on these three holes simultaneously in 5.11 seconds for 82/100¢ per part?

At first glance it looks like a cinch! . . . just use three drilling units with combination tools!

But each hole must also be reamed, and the part has no fixed locating point for a second chucking . . .

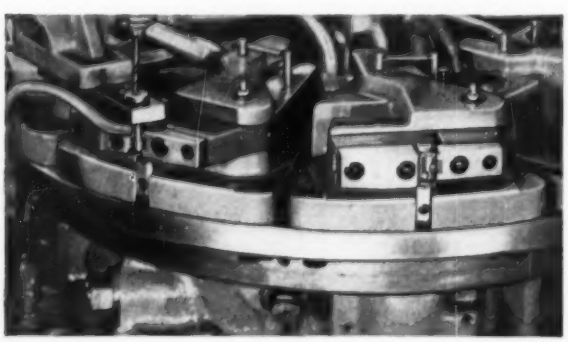
"Operations Kingsbury" maintains high

The part is a steel cylinder ½ inch diameter and 13/16 inch long. Vertical hole is along the axis. Horizontal holes are located on two levels, 67° apart.

Manually-operated work-holding fixtures are designed to hold the part with the axis vertical. It is seated firmly against locators at the bottom, back and left-hand side, and clamped from the right. All operations are performed without removing the part from the fixture.

Six Kingsbury units are mounted on a 60-inch base. Eight work-holding fixtures are mounted on a 20½-inch table, which indexes through eight stations, one used for loading and unloading.

At Stas. 1 and 2 a vertical unit is equipped with a two-spindle auxiliary head. At Sta. 1-V, one spindle drills the .190 dia. axial hole undersize to half depth. A bushing guides the drill. At Sta. 2-V the second spindle drills the hole to full depth. This two-stage operation



Eight precision-built fixtures accurately mounted on the Kingsbury dial assure perfect interchangeability.

is necessary in order to complete this work within the required time period.

At Sta. 3-HR a horizontal unit with combination tool drills the upper (right hand) .253 dia. hole undersize to connect with the axial hole. It also forms the countersink. A similar unit at Sta. 4-HR reams this hole. Bushings guide the tools.

Identical operations are performed on the lower (left hand) hole at Stas. 5-HL and 6-HL.

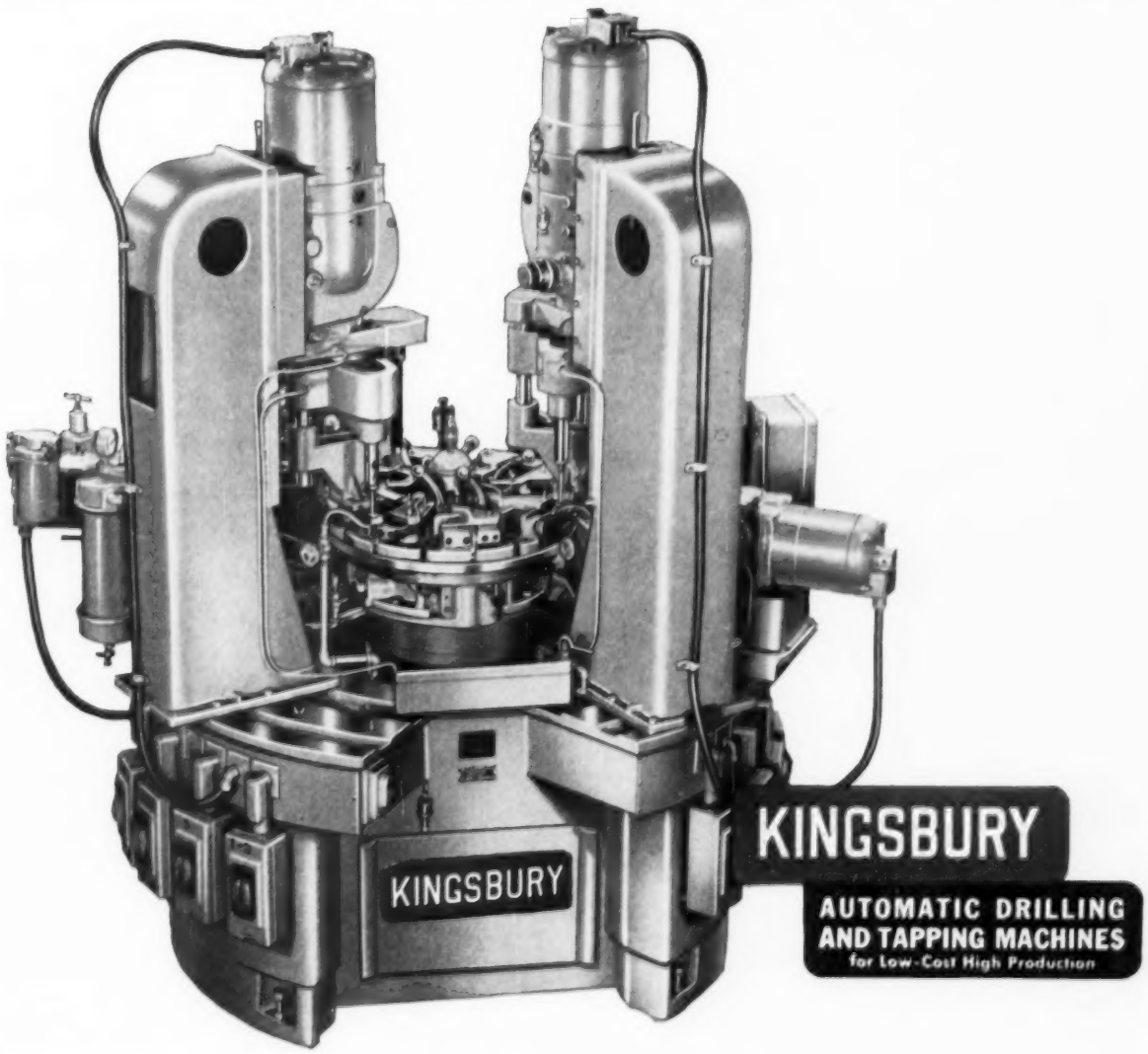
At Stas. 6 and 7, a vertical unit is equipped with a two-spindle auxiliary head. Spindle at Sta. 6-V chamfers the axial hole $\frac{1}{32}$ x 45°. Spindle at Sta. 7-V combination step-reams the hole to .190/.209 diameters, removing the burrs from the break-through of the two horizontal holes.

* * *

Going back to our first premise: it's a cinch — *on a Kingsbury*. But what makes it a cinch? Specially designed work-holding fixtures that are uniformly accurate. Kingsbury heads, bases, indexing tables, electrical controls — all working together in perfect *automation* — *plus* the experience and skill of our engineers who are always looking for better ways to make better Kingsburys. Let us show you!

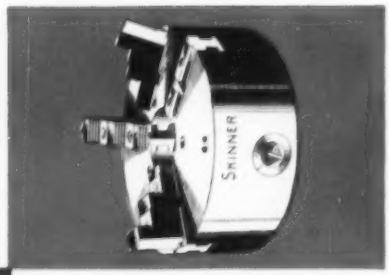
Kingsbury Machine Tool Corp.
118 Laurel St., Keene, N. H.

production of interchangeable parts at low cost



SKINNER

precision self-centering
SCROLL CHUCKS



. . . for long-lasting accuracy and safety!

These powerful chucks are made in sizes from 3″ to 18″ for light, medium and heavy-duty toolroom jobs and production runs. Each is furnished with two sets of solid jaws, or 2-piece jaws for holding internal or external work. The bodies are forged or semi-steel; all other parts are heat-treated alloy steel. Lands on the jaw, jaw steps and end bites are ground after the chuck is assembled. Chucks available for American Standard spindle mountings and with flat backs for adaptor mounts. Skinner carries a full line of standard soft blank top jaws.

Write Skinner or your Skinner distributor for folder.

THE CREST OF QUALITY

THE **SKINNER**
CHUCK COMPANY
203 Edgewood Ave., New Britain, Conn.

The INSIDE STORY
about NATIONAL Keyseating Millers

NATIONAL Keyseating Millers are designed for milling internal keyseats . . . in one cut . . . in offset holes . . . with parallel sides . . . partly through holes . . . of standard width and depth . . . in holes that are closed at one end . . . and many other operations that a keyseating machine can't reach. A demountable guide on body of Miller enters keyseat being milled assuring straight keyseat in perfect alignment with the axis of the bore, thus making it unnecessary to clamp work to drill press table.

CUTTERS are made from high speed Rockwell hardened steel, accurately ground to size. Tops of teeth are staggered to break chips which reduces strain and wear on both cutter and driving pins. It will pay you to put National Keyseating Millers on the inside of your next keyseating job.

national
MACHINE TOOL CO.
CINCINNATI 22, OHIO

WRITE TODAY
for Catalog No. 17
complete, handy size

Free Literature

To order any of these bulletins, please use cards at start of this section—page 148e.

TOOLS AND ACCESSORIES

34 TOOL CONTROL SYSTEM—*Seibert & Sons, Inc, Chenoa, Ill.* 4-page brochure illustrates and describes basic features of unit including tool-holding board, bench, cyclometers, adjustable adapters, gages, and fixtures especially built and assembled for each machine application.

35 HEAVY-DUTY CARBIDE — *Firth Sterling, Pittsburgh 30, Penna.* 4-page bulletin contains information on TXH, a specially designed grade for general purpose work; includes graph charts on cutting speed vs tool life, and performance reports.

36 VIBRATION MONITORS — *Beta Corp, Richmond 26, Va.* 4-page illustrated bulletin 500-1A describes line of manually reset units. Explains how devices detect malfunctions in rotating equipment; gives data on installation and adjustment, features and specifications.

HEAT TREATING AND WELDING

37 WELDER CONTROL—*Sciaky Bros, Chicago 38, Ill.* Bulletin 338 contains information on predetermined, electronic counter Dekatron tube-type control which counts cycles of power line frequency to control welder sequence.

38 BRONZE ELECTRODES — *Ampco Metal, Inc, Milwaukee, Wis.* 4-page illustrated bulletin W-25a describes characteristics, properties, and sizes of five grades of Ampco-Trode electrodes, both ac and dc. Typical applications listed for each grade.

39 SUB-ZERO TEMPERATURE CABINETS—*Webber Engineering Corp, Indianapolis 6, Ind.* Bulletin 61 gives details on Model WE-2-140 with front or top opening, 2 cu-ft capacity, temp range from ambient (110 F) to −140 F. Construction features and applications covered.

PLANT SERVICE EQUIPMENT

40 FLOOR ARMOR — *Klemp Metal Grating Corp, Chicago 38, Ill.* 12-page specification and installation manual illustrates methods for prolonging floor life with Hexteel, a rigid surface armor, and Floorsteel, a flexible steel armored mesh. Includes data tables, filler weights, specifications, installation procedures, specialized uses.

41 STEEL SURFACE TREATMENT—*Chromalloy Corp, White Plains, NY.* 8-page bulletin, "Chromallizing Improves Surface Properties of Steel," describes process for increasing heat, wear, and corrosion resistance of steel by high temperature diffusion of chromium into the surface. Discusses advantages, costs, and applications.

42 MATERIALS HANDLING — *Acme Steel Co, Chicago 8, Ill.* 15-page booklet discusses "Unitizing" method of grouping individual products or packages into single unit through use of steel strapping. 50 applications illustrate how strapping provides faster handling of products, better use of storage space, and increased product protection. Includes skid loading, palletizing, and self-palletizing.

43 HEAVY-DUTY MATERIAL HANDLING PUMPS—*M & E Manufacturing Co, Indianapolis 7, Ind.* Illustrated bulletin PP-56 describes features of units for high volume, continuous operation, primarily on maintenance painting, production finishing, and coating applications. Performance data and applications covered.

Free Literature

44 MAINTENANCE PAINTING EQUIPMENT—*DeVilbiss Co, Toledo 1, Ohio.* Catalog includes description of new P-CGA spray gun for use with 1/2 or 1/3-hp air compressor; new P-QBF paint pump, and portable paint heater. Charts specify correct gun for use with various classes of materials.

45 WALKIE TRUCK—*Raymond Corp, Greene, NY.* 4-page illustrated bulletin 910 describes features of 4000-lb capacity unit with three speeds, powered by four automotive-type batteries to provide 24-v operation for ramps and high-speed travel on long hauls.

46 CRANE & MONORAIL ELECTRICAL EQUIPMENT—*Industrial Crane & Hoist Corp, Chicago 8, Ill.* 12-page bulletin E-156 illustrates and describes equipment including copper wire, bar, T-bar, and enclosed conductors. Rating charts and applications included.

47 DETERGENT OILS—*Sun Oil Co, Philadelphia 3, Penna.* Technical bulletin 44, "Sunvis 700 Oils," gives information on cleaning sludge out of hydraulic and lubrication systems without shutting down machines. Uses, advantages, specific applications discussed.

PARTS AND MATERIALS

48 SLIP RING ASSEMBLIES—*Superior Carbon Products, Inc, Cleveland 5, Ohio.* 4-page bulletin S-2056 pictures and describes complete ring, brush holder, brush and leaf assemblies, and contacts, custom built to specifications.

49 ADHESIVE BONDING—*Rubber & Asbestos Corp, Bloomfield, NJ.* 8-page illustrated booklet describes application techniques, precautions, advantages, and limitations of adhesive bonding at room temperature. Data provided on epoxy based adhesives which need neither heat cure nor pressure.

50 V-BELT DRIVES — *Worthington Corp, Harrison, NJ.* Series of three "V-Belt Trouble Savers" provide illustrated information on common causes of trouble in drives, with solutions and suggestions for correction. Mailer No. 1 tells how to keep drive delivering maximum rpm; Mailer No. 2 covers drives using Worthington Quick Detachable Sheave; Mailer No. 3 describes symptoms of drive failure, gives diagnosis and cures for wide variety of troubles.

51 ETHYL SILICATE FOR PRECISION CASTING—*R W Greeff & Co, New York 20, NY.* 18-page technical booklet describes hydrolysis, gelation, setting and hardening of Montrose ethyl silicate; precoat and investment preparation; typical formulae; solutions of problems; and analysis, specifications, and prices.

52 FASTENERS—*Cleveland Cap Screw Co, Cleveland 4, Ohio.* 3½ x 5¾-in. plastic card lists physical properties such as steel analysis, head marking, tensile strength, Brinell and Rockwell hardness on screws up to 2½ in. in diameter.

MISCELLANEOUS

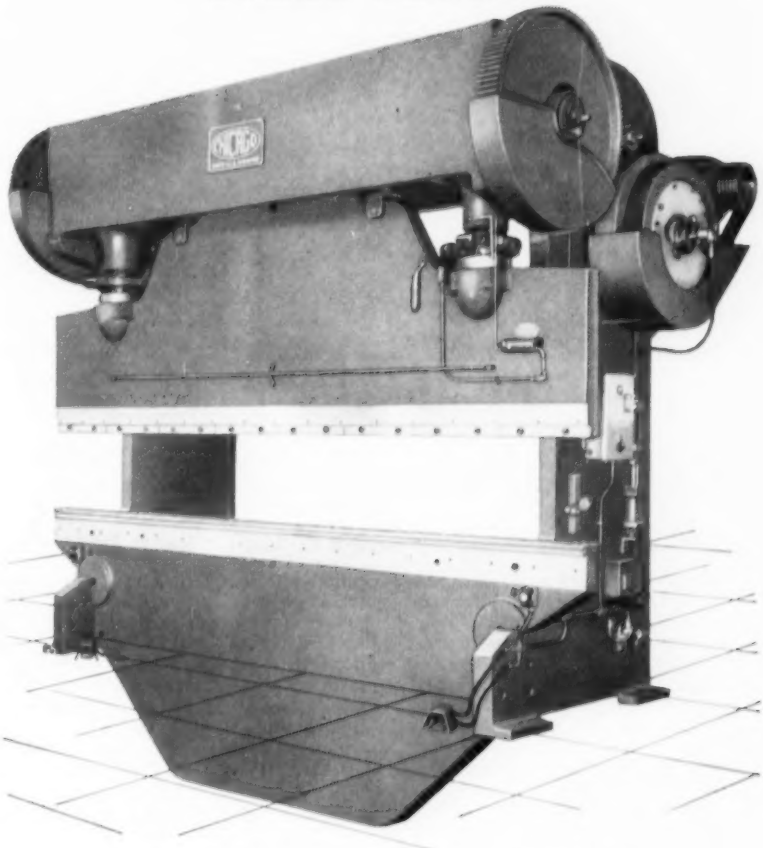
53 FACILITIES & PRODUCTS—*Farrel-Birmingham Co, Ansonia, Conn.* 44-page booklet "This is Farrel-Birmingham," contains illustrated description of facilities for designing and manufacturing a wide variety of heavy machinery and machine tools.

54 CONTRACT WORK ON PRECISION PARTS—*Aero Supply Mfg Co, Corry, Penna.* 8-page illustrated bulletin describes production equipment and facilities for design and manufacture of all types of precision parts on contract basis.

CHICAGO DREIS & KRUMP

Press Brakes

FOR BENDING · FORMING STEEL PLATES



The most modern design throughout with all the features for the fastest bending and forming of steel plates. Large variety of standard sizes and capacities. Also modified designs for special production work.

Complete Engineering Recommendations for Any Job on Request 6160

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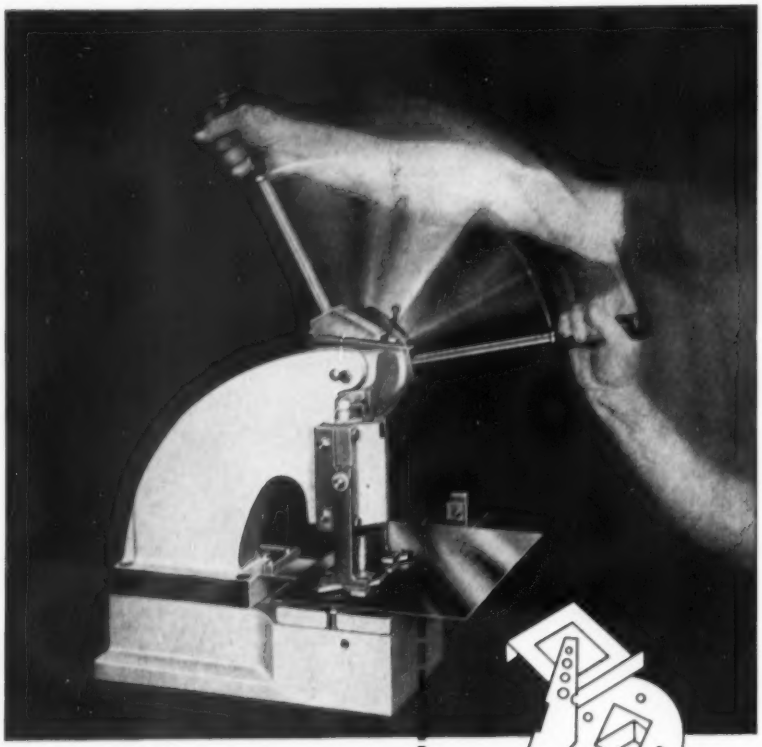
Press Brakes · Straight-Side Presses · Press Brake Dies

Hand and Power Brakes · Special Metal-Forming Machines

DREIS & KRUMP MANUFACTURING CO.

7434 South Loomis Boulevard, Chicago 36, Illinois



Punch..Blank..
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***Quickly, Easily, Accurately with a* DI-ACRO* PUNCH PRESS**

Deep throats—6 and 12 inches—of Di-Acro Punch Presses make them ideal for many operations that cannot be performed on most bench type presses. Holes of various shapes and sizes—as large as 4" in diameter in 16 gauge steel— can be punched. Vee shaped ram controls position of punch head assuring perfect alignment. Turret stripper, of exclusive Di-Acro design, strips material from punches of all shapes. Side and back gauges provide exact work positioning.

FOUR HAND AND POWER MODELS AVAILABLE

Di-Acro Power Punch Presses are designed for high speed production. Rated capacity, five tons. 180 strokes per minute. Motor driven flywheel, other moving parts housed in welded steel cabinet.

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PUNCH PRESS ACCESSORIES

Complete line of standard size punches in round, square, notcher, rectangular and oval shapes available in six clearances. Also special sizes.

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di-acro PRECISION METALWORKING MACHINES

Free Literature

55 USED MACHINERY — *Interstate Machinery Co, Chicago 9, Ill.* 40-page catalog presents illustrated descriptions of complete stock, plus details on new machinery available.

ROUND TABLE *Discussion*

WORKING THROUGH THE BREAK

If a man doesn't feel like taking advantage of the coffee break, should he be asked to conform? Are the other workers justified in feeling that his apparent diligence makes them look like loafers?

This is a free country and no man should be compelled to drink anything he does not choose to drink. Al would be operating by the Russian system should he tell Barrett that he has to take a coffee break whether he wants to or not. This is the action and thinking of medieval times and is a very sad exhibition of the extremely slow development of civilization.

I remember once when I visited the famous Haddon Hall, which was built in the twelfth century in England, I saw a wrought iron clamp on a doorpost and the caretaker explained that this was used to inflict punishment on obstinate men who refused to drink their horn of liquor to the annoyance of the other revelers who insisted that every man quaff his allotment. It seems that any man who did not choose to join with the rest of the men in—let us call it

"Had a rough day today—I had to stop the machines three times"

the Booze Break—had his right hand held above his head and fastened in the clamp and then his quota of beer was poured down his sleeve as a punishment for his daring attempt to be a little different from the general run of the carousers of the evening. Apparently Al has not advanced very much ahead of the medieval times in his thinking and has let himself be outpassed by Ed who agrees that a man has the right to do as he pleases so long as he breaks no law.

Some men do not like coffee, some do not feel thirsty at ten o'clock in the morning, some have their work running very smoothly at ten o'clock and do not wish to be disturbed at the moment to start something else. Take a designer, for instance; perhaps at ten o'clock he is in the middle of a complicated calculation, or has a stress diagram half completed, or has just got an idea for an improved electronic circuit; or a toolmaker who has just started a glass-smooth finishing cut. Why should these men be told that they *must* drop whatever they are doing and go somewhere else and take a drink of coffee, whether they like it or not?

The compulsory coffee break, and similar notions, are in direct opposition to the ideas that the manager of a large shipbuilding firm held at the time they started to use high-speed tools. The armor-plate bolt production department foreman believed in keeping up with every improvement. As soon as high-speed steel was developed he personally went to the steel works where it was made and learned about it by actually running one of their high-production heavy-duty lathes and thus became familiar with the previously unheard of cutting speeds. He then equipped his department with the new high-speed tools and showed each operator how to remove the maximum amount of metal in a minimum amount of time: the novelty of high-speed cutting with heavy feeds developed a quick popularity among the lathe hands. After a few days a startling discovery was made. The piece rate for turned bolts had been figured on regular steel tools and now that the bolts were being produced at an unheard-of rate the weekly pay had risen also to an unheard-of amount.

Of course the men were pleased, and who would not be at the prospects of double and triple pay, but upon more careful discussion it was decided that consideration should be shown to the company for, after all, it had to pay much more for the high-speed tools. Furthermore, all the

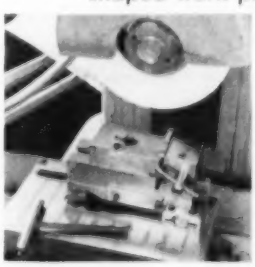
J & S SINE VISE

". . . the most practical precision vise ever developed . . . saves 25% in time . . . (on die sections and intricate parts)"

says MEDVED TOOL & DIE COMPANY
Milwaukee, Wisconsin

Here's Why . . .

- Vise is square within less than .0001" in 1", in 4 positions.
- Clamping jaw of vise SWIVELS, holds tapered and odd shaped work pieces.



- Down holding clamping feature.
- Stop, for accurately repeating position.
- Rapid loading and unloading.
- Attachable to sine angle plate in six different positions.
- Sine plate has .100 recess for small angles.

GUARANTEED PRECISION . . . Every J & S Clampcut Sine Vise is Hardened and Ground, then Stabilized in Liquid Nitrogen.

J&S TOOL CO. INC. — CLAMPCUT

J & S TOOL CO., INC.
870 DORSA AVE.
LIVINGSTON, NEW JERSEY

machines now were too weak to permit the new tools to give full production so they would soon have to be replaced with the heavy-duty type. It was finally decided that a 35% to 40% reduction in piece rates would be fair to everyone concerned and a delegation was chosen to visit the general manager and explain the new situation, stating what they thought should be done about it.

The manager listened to the delegates, said he appreciated their consideration for the firm's future progress and stability, but he would have to investigate the matter thoroughly before he could reply, or make any decisions, and so he asked the delegates to return in a couple of days. At the next meeting the manager said that he had had a complete investigation made and that there was no question but that the firm would be unable to maintain the present price rates, for very soon all their competitors would be using high-speed tools and then reduce their prices. A 35% reduction in piece rates, he estimated, would be fair to all. However, this reduction would not be put in effect for any work done on contracts already on the books, because these contracts had been figured on the production by regular tools; therefore, the piece rates in effect at that time would continue to be in effect and the delegates were told to inform their fellow workers that the high piece rates would be continued, and they could earn the high pay checks until such time as they started working on new contracts and then the rates would be adjusted to a fair balance with the new high-production output.

George P Pearce
Albuquerque, NM

"SHUT that fan off a minute . . . I can't tell whether he's working or just swaying in the breeze."

When product designs for welded steel

Have twice the rigidity... three times the strength

Yet require less material ...cost less to fabricate

WHY

aren't all your products designed for welding?

THE WELDED WAY

...cuts deflection 60%

...costs 28% less

Welded steel square shear bed for Famco Machine Company, Kenosha, Wisconsin, is more accurate because it's more rigid.

Have Lincoln help you duplicate these benefits now.

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Dept. 2013 • Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

"Order Me Out a Batch of Gears"

Paul W. Thurnauer Jr.

VICE-PRESIDENT, THE CINCINNATI GEAR CO.

How do *you* go about buying gears for your products? Get the best price in order to "save" as much money as possible? Well, economy *is* important, and maybe you can save some money if you consider only the original cost — a few pennies on the price tag of each gear. But how much is this "saving" (if realized) in the *percentage* of the total cost of your product — one or two percent?

Such an amount can disappear in a hurry. A gear is a very critical part in a product; it has a lot to do with the efficiency of the product and the ultimate satisfaction the product gives your customer . . . an importance far beyond its relative size *or price*. That's why we say the *right* gear is more important than the *cheapest* gear.

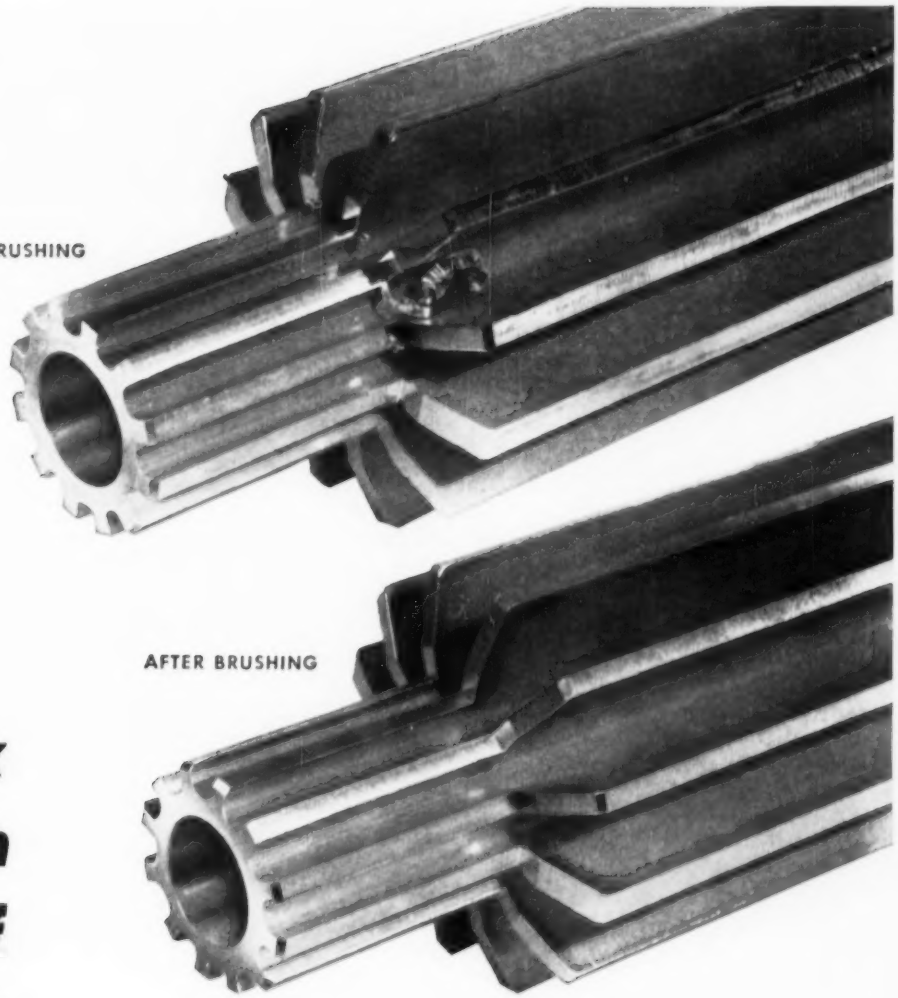
Certainly, in competitive times such as these, it is necessary for any manufacturer to reduce costs wherever possible. But when cost-cutting affects product quality or efficiency, watch out. The saving in dollars and cents on a "cut-price" gear is usually pretty small, if there is a saving at all, over buying the gear that is assuredly "right" for the job. And if your specifications indicate possible use of a custom gear, talk to someone from Cincinnati Gear first and let him point out the advantages of custom gearing, and how good gears can be an economy in the long run. You'll find that putting the major emphasis on getting the *right* gear for the job will pay off handsomely.

THE CINCINNATI GEAR CO.

CINCINNATI 27, OHIO

"Gears—Good Gears Only"

CINTI



Quick brush off for burrs

MACHINING this extruded aluminum armature shaft for an aircraft generator turns up heavy burrs. However, Osborn's power brushing method quickly removes burrs and—at the same time—blends all sharp edges.

This is typical of how industry is using Osborn power brushing to improve and speed up thousands of finishing operations.

An **O**sborn **B**rushing **A**nalysis made in your plant will show how *you* can profit from Osborn power brush finishing. Write *The Osborn Manufacturing Company, Dept. C-47, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

See how
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JIG BORER
direct-reading
micro-optical
measuring system
with "Autopositioner"

speeds initial and repeat table settings-guaranteed accurate within .00015"

readings in .00005" no gauges, blocks or bars

table sizes
44" x 24"
32" x 16"

SEND for 25-minute movie film demonstration

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Names in the News . . .

Neil E Firestone has been named manager of Manufacturing Operations Service, General Electric Co. He was formerly consultant on manufacturing organization analysis. **Armand V Feigenbaum** has been appointed manager of Quality Control Service, a newly established component in Manufacturing Services. He has been serving as manager of quality control and cost reduction.

George J Carvalho, former manufacturing superintendent of the Universal Winding Co, Cranston, RI, has been appointed general manager of Jarvis Power Tools, Inc, subsidiary of Jarvis Corp, Middletown, Conn.

Alex P Fox has been elected vice president of the Lincoln Division of McNeil Machine & Engineering Co, Akron, Ohio. Mr Fox served as president of Lincoln Engineering Co until its recent merger with McNeil Machine. **Jonathan Kludt,** former vice president in charge of production at Lincoln, has been named general manager of the Division; **John E Renner,** former vice president, sales, has been appointed general sales manager; and **Carl H Mueller,** former vice president, engineering, has been named divisional director of engineering.

A H Lewis, has been appointed manager of tool steel sales for Crucible Steel Co of America. He was formerly sales manager of Vacuum Metals Corp, a Crucible affiliate. **Frank J Coates** takes over Mr Lewis' post. He has been serving as supervisor of stainless steel sales at Crucible's Cleveland branch office.

Rea I Hahn, former General Motors Corp executive, has been elected president of Walker Manufacturing Co, Racine, Wis, manufacturer of automotive exhaust systems.

Walter R Lowry, vice president of Beryllium Corp, has been elected president. He succeeds **Matthew J Donachie,** who has retired.

Everett O Clark, manager, industrial products sales, for Vickers, Inc, has been named manager of the recently opened midwest branch. **W F Driver,** Seattle, Wash, district manager, succeeds Mr Clark. **Donald G Wilson** has been promoted from assistant to master mechanic for Detroit operations.

Edward J Vargo, chief metallurgist of Alloy Precision Castings Co, Cleveland, has been appointed plant manager.

Earl W Haefner has been appointed assistant to the president of Borg-Warner International Corp.

Angelo J Perna has been named director of engineering of Kaydon Engineering Corp, Muskegon, Mich. Mr Perna was formerly associated with Pullman Standard Car Co, Hammond, Ind, as head of structural research and development.

Harry Goenner has been appointed quality control manager for all plants of the Proctor Electric Co, Philadelphia. He has been serving as superintendent of the Aircraft Division.

Hobart H Hartong has been named chief engineer of the Joliet, Ill, plant of Philips Control Corp, manufacturer of relays, solenoids, and control devices. He has been a member of the engineering department for the past six years.

Frank A Votta, Jr, has been appointed chief engineer of the Hunter Spring Co, Lansdale, Penna. He is rejoining the company after two years' association with Philco Corp.

W A Pulver, chief manufacturing engineer of the California Division of Lockeed Aircraft Corp, has been named assistant chief engineer of the company's Ceorgia Division at Marietta.

Leo S Ohman has been appointed plant manager at the Mechanical Division of General Mills. He was previously works manager at Scott-Atwater Manufacturing Co, Minneapolis.

Charles R Ogsbury, president of Commercial Controls Corp, Rochester, NY, subsidiary of the Friden Calculating Machine Co, San Leandro, Calif, has been named vice chairman of the board of the parent firm.

William E Sauter, has been appointed assistant to the president of C I Hayes, Inc, industrial heat treating furnace manufacturer of Providence, RI.

Jeno Paulucci, President of Chun King Sales, Inc., says

"You're looking at a million-dollar menu!"

"Only two years ago, we started freezing our Chinese food and selling it around Minnesota.

"Now, we've sold millions of dollars' worth throughout the U.S.A. – captured half of a $25,000,000 market – all with food prepared in our one plant in Duluth!

"Food brokers and buyers receive our Chow Mein, Egg Rolls or whole Cantonese dinners anywhere in the 48 states – within a few hours!

"How do we do it? We pack these new delicacies in dry ice and rush them Air Express! With Air Express, they travel fast and sure, taking hours instead of days for delivery.

"Air Express never fails us. In fact, it's opening up the whole country as our regular market.

"And yet, most of our shipments cost less than any other air service. 15 lbs., for instance, Duluth to St. Louis, is $4.67. It's the lowest-priced complete air service by $2.98!"

Air Express

GETS THERE FIRST *via U.S. Scheduled Airlines*

CALL AIR EXPRESS . . . *division of* RAILWAY EXPRESS AGENCY

production begins with

Columbus Die-Tool

It takes the right machinery to build your product right! Columbus Die-Tool individually designs and builds tools, dies, and special machinery to produce your product alone. This gives you the advantages of lower operating cost, greater production and a higher quality product.

Let Columbus Die-Tool's more than 50 years of designing and engineering experience go to work for you. Contact CDT today about your special die, tool and machinery requirements.

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AND MACHINE COMPANY
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ESTABLISHED 1906
Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

VAILL
TUBE END-FORMING MACHINES
shape and form tube ends
fast...accurate...at less cost

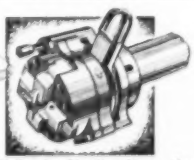
FREE—New Bulletin T-1 shows, describes VAILL tube end forming machine VERSATILITY for . . .

Beading • Flaring • Flanging • Sinking
Expanding • Grooving • Threading • Reducing
Double Lap Flaring • Double Lap Flanging

on Tubing up to 6"Diam.

THE VAILL ENGINEERING CO.
135 E. MAIN STREET WATERBURY 20, CONN.

H&G Insert Chaser DIE HEADS



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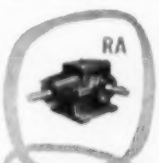

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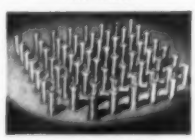
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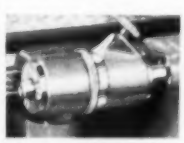
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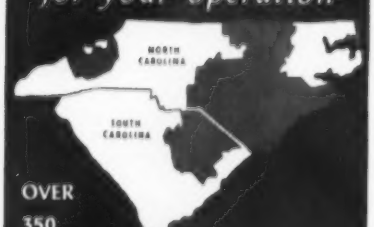

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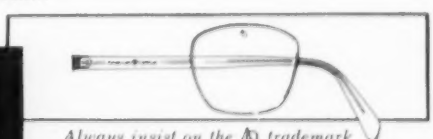

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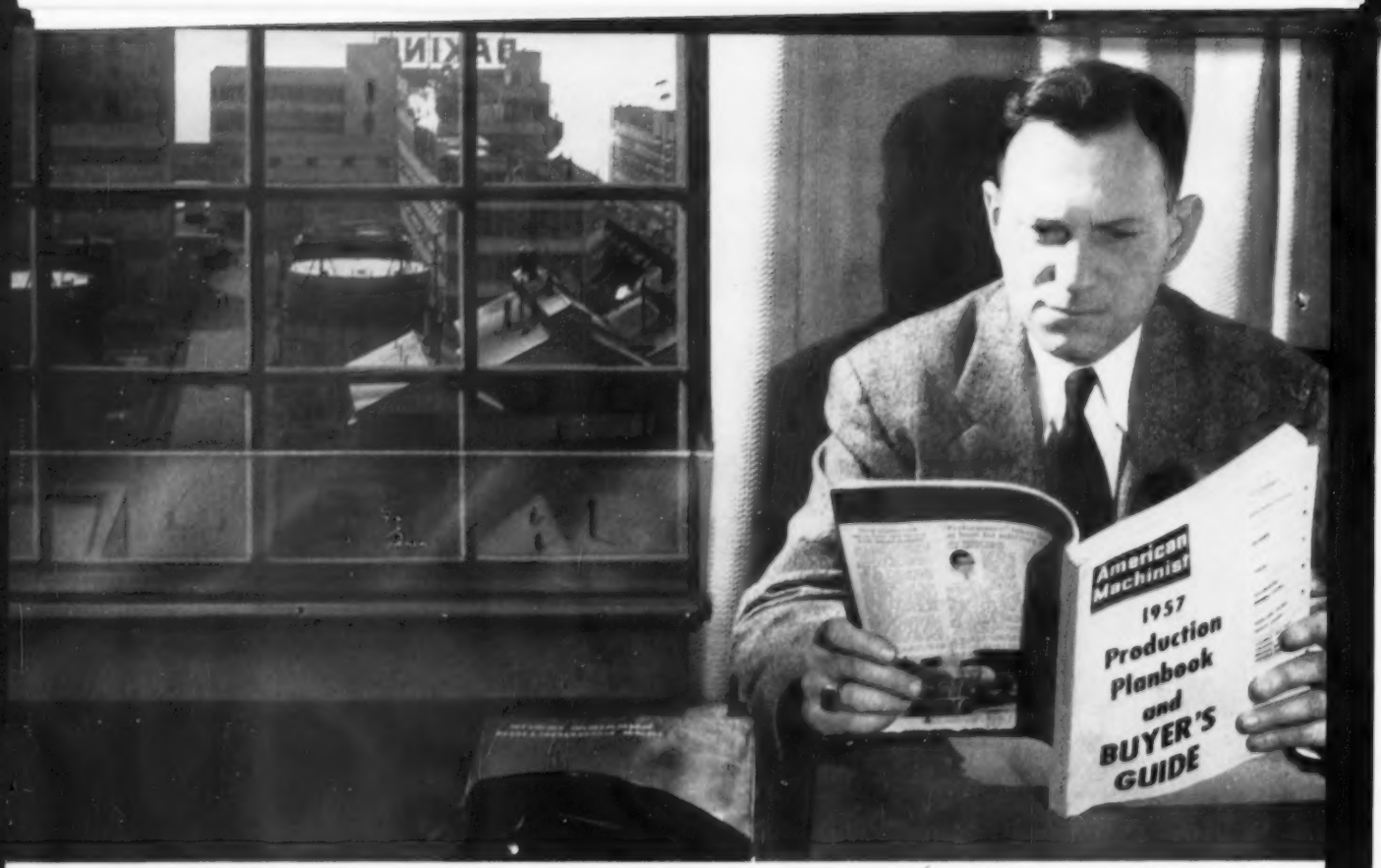

WHAT'S AHEAD?
...AM's New Packaged Planning

NEW YORK—A Buyer's Guide listing over 7000 sources of supply for the production equipment, materials, parts and supplies needed by American Machinist's subscribers will be incorporated into the 1957 Production Planbook issue due to be mailed to subscribers in November.

The Buyer's Guide section will list under more than 1400 headings, the names of manufacturers of the entire gamut of products used by Metalworking plants—from fasteners to big production machines—from sheet steel to electric motors.

Formerly a regular feature of *American Machinist*, the Buyer's Guide was discontinued during World War II. It is now resumed in expanded, complete, and authoritative form, providing an exclusive "Where-to-Buy-it" service for *American Machinist* subscribers.

Other Subscriber Values

Production "Nuggets" usually found in previous Production Planbook issues, and which have proven so useful, will be another major feature. These are the essence of the production ideas published in regular issues of *American Machinist* throughout the year. They are classified by subject matter, with issue dates and page numbers for easy reference to articles and reports—of interest to subscribers who want more specific details with drawings, diagrams and illustrations.

"Developments to Watch in '57," an innovation this year, will give subscribers a check-list against which to measure procedures and requirements of their shops, compared with the latest production ideas and techniques—challenging to every Metalworking production executive and engineer.

Easy to Use

Flat-opening, thumb-indexed and classified by topic, *American Machinist*'s 1957 Production Planbook and Buyer's Guide Issue is organized into 11 idea-stimulating sections for year-round usefulness:

- **1957 Outlook** — for Production Planning Ahead.
- **Section A** — Management and Personnel Developments.
- **Section B** — Machining. Metal-removal techniques and production equipment required; automation devices and methods; cutting fluids, grinding wheels; and other elements associated with removing metal.
- **Section C**—Tooling. Articles devoted to the jigs, fixtures, dies, holding devices and press tools used in conjunction with metal removal and metal forming production equipment.
- **Section D**—Presswork, Molding,

1957 Production Planbook and Buyer's Guide Issue to contain everything you need to plan ahead

- **Need new modern production equipment?**
- **Planning increased production at less cost in '57?**
- **How can you use automation?**
- **What about new materials and how to work them?**
- **Puzzling over commercial parts and supplies?**

For real production help depend on AM's 1957 Production Planbook and Buyer's Guide Issue due Mid-November 1956

is a Metalworking First

Casting. Everything reported during 1956 on forming metals, with the necessary equipment, accessories, and tools.

- **Section E**—Inspection, Testing, Quality Control. 1956's developments in a highly interesting, problem-in-every shop group of topics, all rounded up in a single reference section.
- **Section F** — Assembly, Heat-Treat, Finishing. "How-to-do-it" production ideas covering the year's reporting of assembly, heat-treating and finishing techniques and equipment, including hand and portable power tools.
- **Section G** — Materials, Components. New materials of manufacture; new developments in the use of existing materials; what others are using for specific applications; pneumatic and hydraulic mechanisms and attachments; and gears, parts, valves, and other components.
- **Section H**—Materials Handling, Services. "How-to-move-it" fork-lift & conveyor, crane-hoist and other materials handling information, as well as new developments in automation not elsewhere covered. Also covers inventory and work-in-process control systems; disposal, reclamation and exhaust ideas.
- **Section I**—Prize Ideas, Rebuilt Equipment
- **Section J**—Buyer's Guide

Three-Fold Usefulness

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1957 OUTLOOK	
MANAGEMENT, PERSONNEL	A
MACHINING	B
TOOLING	C
PRESSWORKING, MOLDING, CASTING	D
INSPECTION, TESTING, QUALITY CONTROL	E
ASSEMBLY, HEAT-TREAT, FINISHING, (ASSEMBLY INCLUDES WELDING & PORTABLE TOOLS)	F
MATERIALS, COMPONENTS	G
MATERIALS HANDLING, SERVICES	H
PRIZE IDEAS, REBUILT EQUIPMENT	I
BUYER'S GUIDE	J

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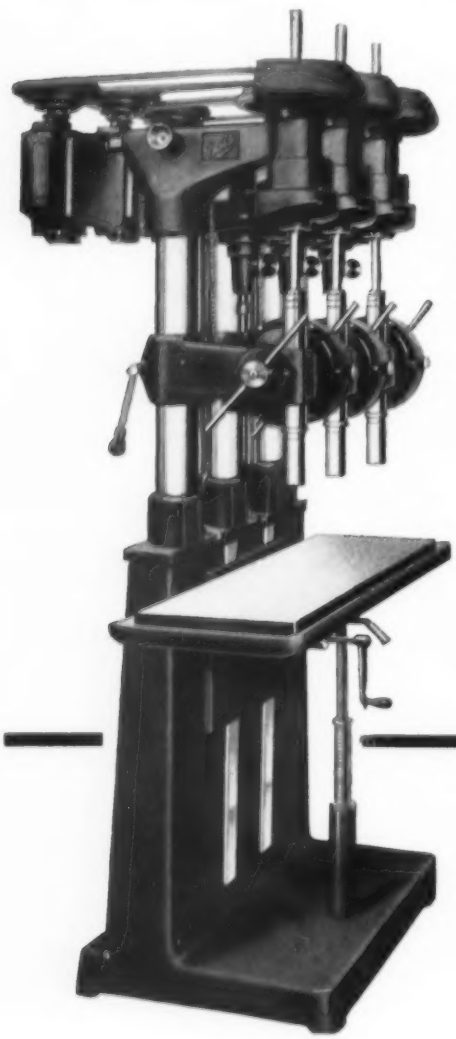

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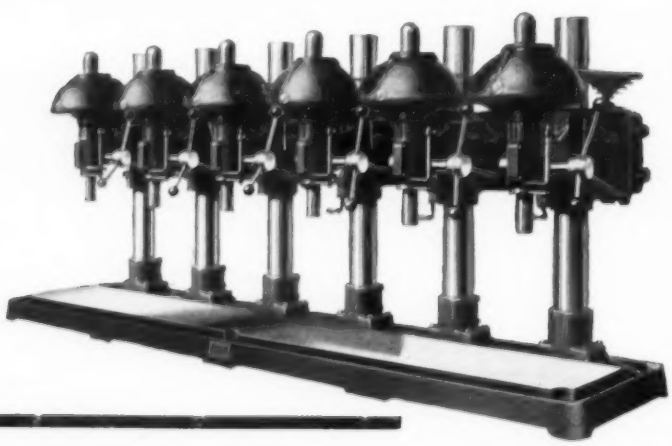

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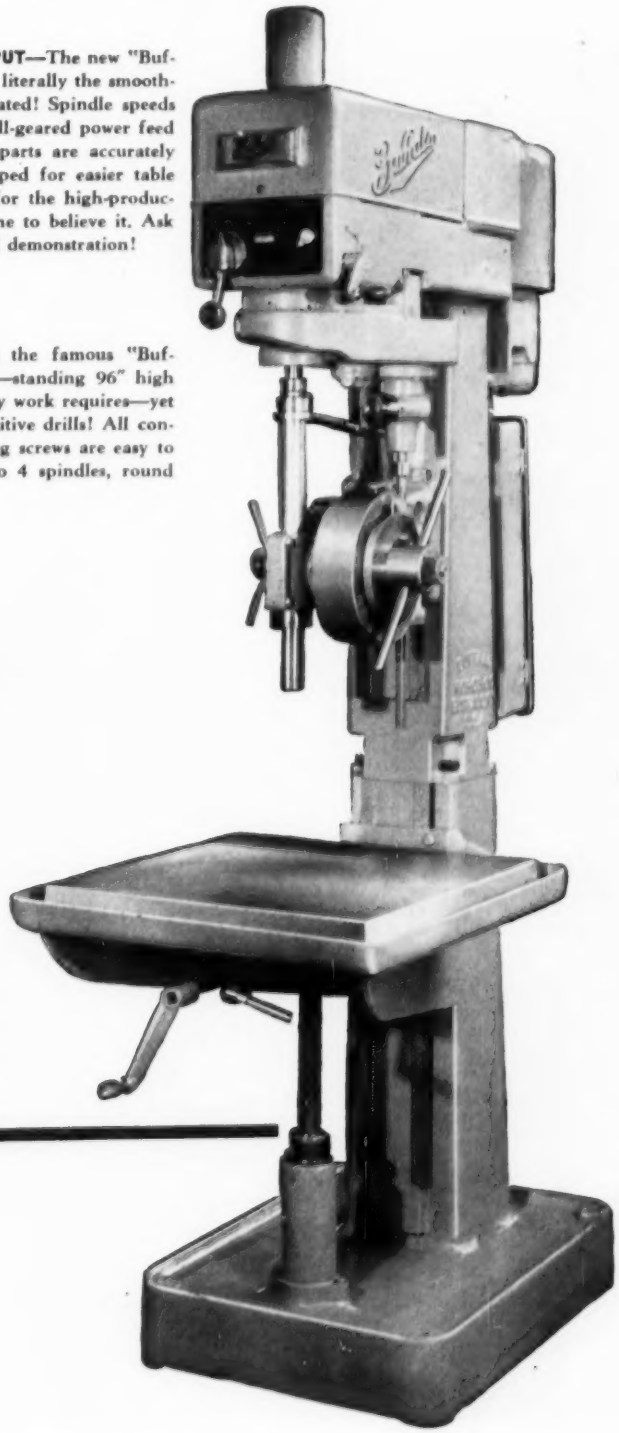

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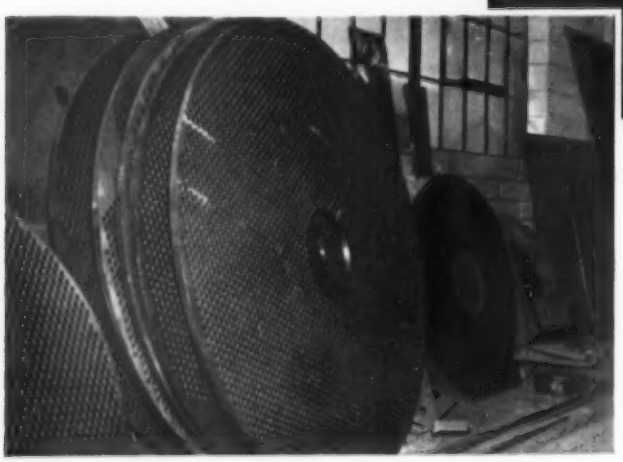
ONE OF THE 4 EVAPORATOR SHELLS made of Revere Silicon Bronze, fabricated and installed by CLEAVER-BROOKS MFG. CORP., Waukesha, Wisconsin.



EIGHT TUBE SHEETS LIKE THESE were used in the Bermuda installation . . . 2 per evaporator. Each tube sheet, made of Revere Silicon Bronze, is 86" in diameter, 1¼" thick and weighed approximately 1,360 lbs. after drilling.

Largest

VAPOR-COMPRESSION SEA WATER DISTILLATION PLANT

Made and installed by CLEAVER-BROOKS

. . . Vital distillation units fabricated from

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This plant installed at the Kindley Air Force Base in Bermuda has a total daily capacity of 200,000 gallons and eliminates the dependence of the Base on rainfall or shipment of water by tankers.

Distilled water is produced in the ratio of 300 lbs. to each pound of Diesel fuel. Total costs are estimated at $1.25 per thousand gallons of distilled water. Nearly every component part made by Cleaver-Brooks is about twice the size of its largest previous counterpart. For example, the evaporators are 16½ feet high. Each, with its component parts, weighs approximately 40,000 lbs., the empty Revere Silicon Bronze shell alone accounting for 28,000 lbs.

There is an interesting story behind the development and manufacture of this equipment. The four huge pressure vessels had to be fabricated of Revere Silicon Bronze Alloy No. 420. Knowing Revere's wide experience in welding copper-base alloys, Cleaver-Brooks called in a Technical Advisor, and gave him a complete set of blueprints of the vessels, with a request for suggestions regarding joint design and welding techniques. He in turn consulted the Welding Section of the Revere Research Department. Their recommendations were adopted, and the customer reported that the original estimate of welding time had been cut considerably, reducing production costs correspondingly.

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The rectangular objects at rear of photograph are the "Downcomers" which bring water down from the top of the steam separator. The tubes in left foreground are "Hotwells," which receive the distilled water discharge from the evaporator shell.

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A MESSAGE TO AMERICAN INDUSTRY • THIRD OF A SPECIAL SERIES

THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

A Threat to Economic Progress

THERE are two paramount reasons for concern over the serious shortage of scientists and engineers that now confronts the United States:

- The first reason, with which this editorial deals, is that continued expansion of our economy and further increases in our living standards are threatened unless we train more scientists and engineers and use them more effectively.
- The second reason for concern is that we run the risk of falling behind the Soviet Union in the technology so essential to national security. The consequences of losing this race to the Russians are not comforting. (The possibility that this might happen over the next few years was discussed in an earlier editorial in this series.)

The crucial contribution of scientists and engineers to the well-being of the American people has been to find ways of making better use of limited resources, to make equipment more productive, to develop new and better products that enrich our lives, to enable us to live longer and be healthier. They have made this contribution with greater success in the last 15 years than ever before, but it has required progressively more resources and more trained people.

During this 15-year period our annual production of goods and services, in dollars of constant purchasing power, has almost doubled. Since our total population has increased only 25 percent, this has meant a tremendous rise in the economic well-being of the American people as a whole. But in accomplishing this, the number of scientists and engineers has been more than doubled.

Tasks for Research

If the American economy is to continue to grow and if our living standards are to show further improvement, the work of scientists and engineers must be stepped up even more in the years ahead. Unless answers to several pressing problems are found through intensified research efforts, economic progress will become increasingly more difficult.

Productivity per hour of labor must be increased at a faster rate. Improved medical care has greatly increased the number of people who attain retirement age, and sharply higher birth rates since the war will mean larger numbers of children in school and college. Meantime, because of low birth rates during the depression, the number of people reaching working age is not rising nearly so fast. The result is that over the next 20 years our population will increase by about one-third, while the total manhours worked are not expected to increase more than 15 percent. So, simply to maintain the same living standards for a rising population — with no provision for additional improvements — ways must be found to enable each worker to produce for more dependents.

It is primarily to the scientists and engineers that we must look for help in making human labor more productive. This will require enormous increases in our power

resources. We will need to make more effective use of our existing fuel supplies — coal, oil and natural gas. And we will have to devise economically practical means of tapping other energy sources, particularly nuclear power and new rocket fuels.

Also, better ways must be found to use scarce and low-grade raw materials. Thanks to great strides in metallurgy and mining techniques, we are now utilizing sources of copper and iron ore that, for all practical purposes, were not available to us only ten years ago. Similar strides are needed in the mining and processing of bauxite if low-grade domestic ores are to help satisfy a fast-growing market for aluminum. And stubborn technical obstacles in the area of "high temperature" metals—such as nickel, cobalt, columbium, tantalum and titanium — are impeding progress in jet and turbine engines.

These are only a few of the challenging tasks that demand intensified research and engineering activity in the years immediately ahead if the United States is to continue to raise living standards. We need more houses, schools and highways for a rising population, more medical research to reduce further the ravages of illness, more research in chemistry and other sciences to sustain the flow of new and improved products that are so essential an ingredient of our economic progress.

Ceiling on Growth

American industry has indicated that it is ready to meet the challenge and undertake vastly expanded research programs. A recent survey conducted by the McGraw-Hill Department of Economics revealed that total research and development expenditures of American industry were almost $5 billion last year, 29% higher than in 1953. By 1959 business plans to be spending well over $6 billion on research and development. And the total could well prove to be much higher, based on the trend of recent years.

But industry's programs for research and development cannot be carried out unless enough qualified research workers and engineers are available. Ernest R. Breech, chairman of the Ford Motor Company, recently described the supply of engineers as the "ceiling on our future growth." He gave force to his point by announcing: "If 900 qualified engineers were to approach us next week looking for jobs, we would hire every one." The U. S. Bureau of Labor Statistics found in interviews with some 200 large companies at the end of 1954 — a recession year — that at least half were unable to hire enough research scientists and engineers to meet their needs. A third of the companies reported substantial shortages of technical personnel.

The shortage of technically trained people, furthermore, is becoming more acute. The number of engineers and scientists now being graduated is only about enough to cover replacement requirements, while the needs of industry, government and education are mounting every year. According to the best information available — as indicated in the first editorial in this series — these needs are now about twice as great as our current engineering graduating classes and annual production of scientists with Ph. D. degrees.

To perform the research needed to remove roadblocks to our economic progress — and at the same time hold our own in the technology essential to our security as a free nation — we must have an adequate supply of men and women with engineering and scientific training. Instead, we are faced with an acute shortage, now and for several years to come. Reasons for the shortage and proposals for working our way out of the shortage will be discussed in the remaining two editorials in this series.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

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Chipping and Edge Breakdown Eliminated by Switching to **STELLITE** *Alloy Tools*

HAYNES STELLITE Star J-Metal tools mill an average of 220 of these cast iron differential housings per grind despite periodic contact with hard white iron spots. Chipping and edge breakdown, major problems when other tool materials were used, have been eliminated by switching to STELLITE alloy tools. As a result, unscheduled down time has been drastically cut. About 3/16 in. of stock is removed from each casting with 0.010 to 0.012 in. chip load per tooth. Cutting speed is 88 surface ft. per minute. The 40 standard Ingersoll-type blades mounted in a 12-in. cutter can be counted on for a full shift's production.

HAYNES STELLITE alloy tools are successful on applications like this one because they have good impact strength, high compressive strength, and their cutting edges remain hard and sharp even when red hot. They resist chipping and spalling in spite of severe shock. Metal removal is fast because high speeds, comparatively high feed rates, and deep cuts can be used.

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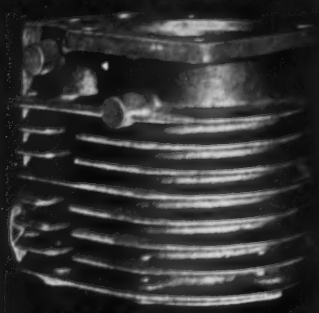

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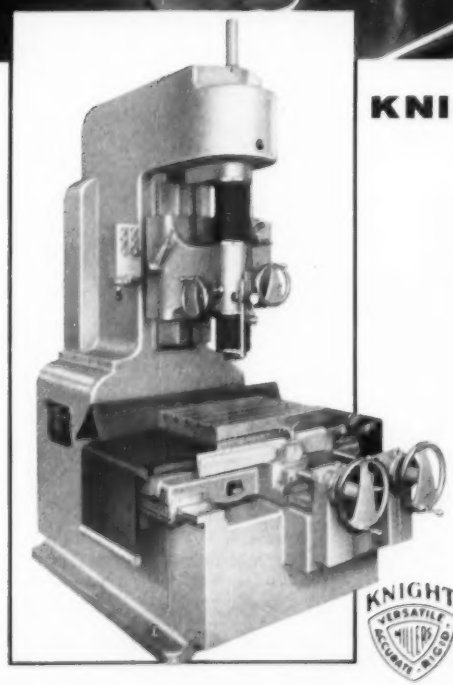

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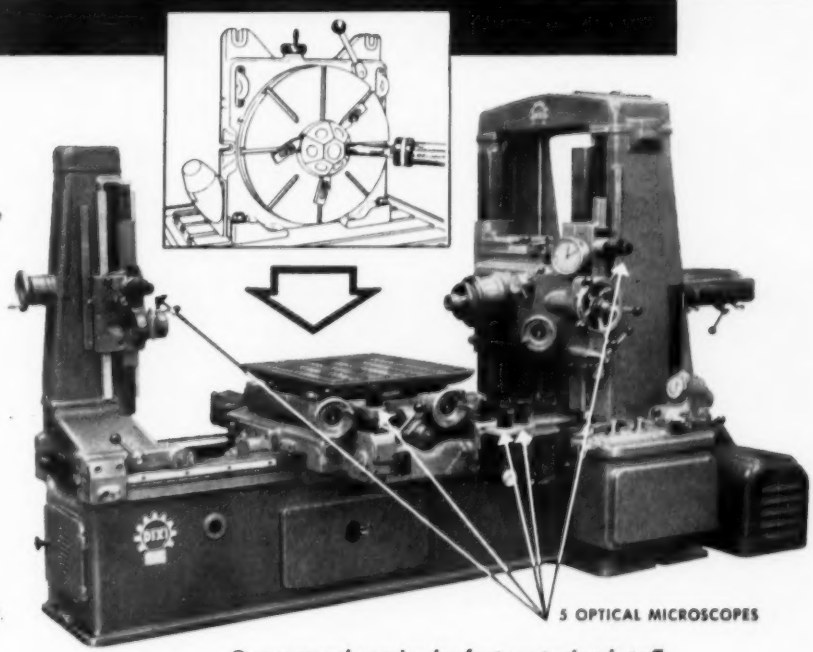

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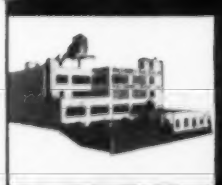

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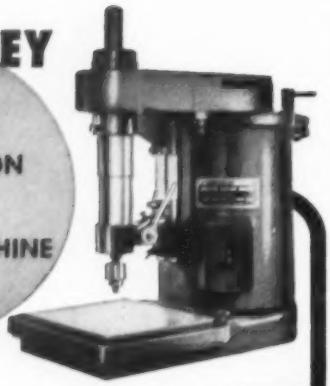

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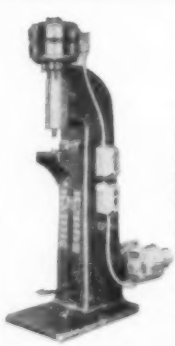

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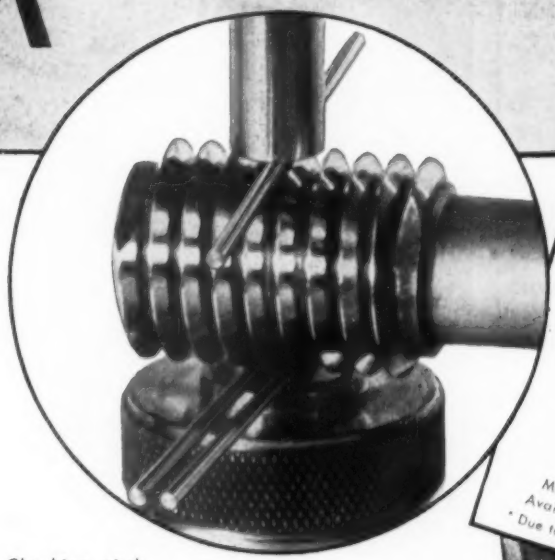

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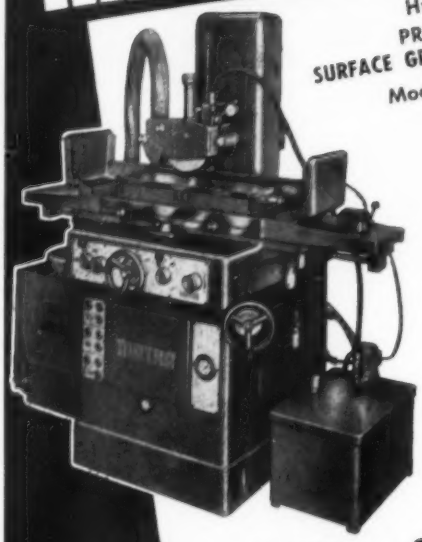

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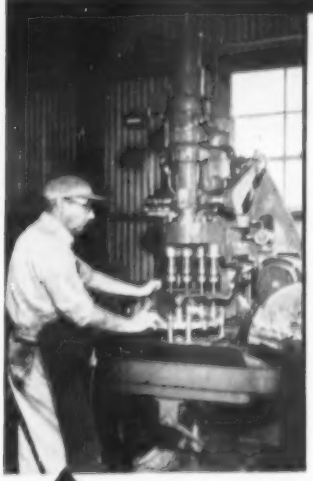

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Gaging . . .

the Surplus Machinery Market

General business climate across the country is a bit cloudy these days, with some bright spots but more dull spots. There's been little change in the market situation in the last month or so. Part of the slowdown can be attributed to the usual summer slackoff: part to higher-than-usual selling during the first five months of this year. But slowdown or no, nobody's kicking, and when the year is tallied up, it'll be a banner one.

Dealers generally don't expect much of a pickup for at least three months—maybe not until after the November elections.

Every dealer you talk to these days, it seems, is hot under the collar about auctions. A lot of them say that one reason business is comparatively slack is that they have had to let their stock of available machines fall below normal levels because they can't afford to restock at current auction prices.

Even the dealers who do stick their necks out and bid on machines at abnormal prices can't afford to put them into stock. In a good many cases they already have commitments from buyers before they bid—or else they're pretty sure they can unload a particular machine in a hurry. An auction-bought machine of any quality at all these days can tie up a lot of dealer capital.

One Midwestern outfit figures auction prices have gone up at least 15%, sometimes as much as 25%, at auctions in the last 60-90 days. Another is sure prices have jumped 30% in the last six months.

Still another dealer says he'll attend some big upcoming auctions but, as he puts it, "only in the interest of self-protection." The auctions look good on paper, he says, but except for "junkie-type" machines, he doubts that they'll amount to much.

If you read the Machine Tool Page in the last issue, you'll have seen that both the Navy and the Air Force are going in for full-scale replacement programs. That means both Services are going to be unloading a tremendous number of used machines.

Trouble is they'll be in poor shape—by the very standards set as replacement criteria. Air Force, for instance, will unload (1) all machine tools bought before World War II that need repairs of any kind, (2) all tools bought from 1941 to 1946 that will take 25% or more of their original purchase value to fix, and (3) any tools bought since 1946 that will take 35% of their purchase price to repair. That means that unless you want to spend a fortune fixing them up, think twice before you buy.

If it's true that "as Detroit goes, so goes Metalworking" watch out for storm clouds. Here's what dealers there report: "Business is very quiet—and we mean quiet by any standards, and not by comparison with the first quarter, which was very good. This month in particular is too quiet."

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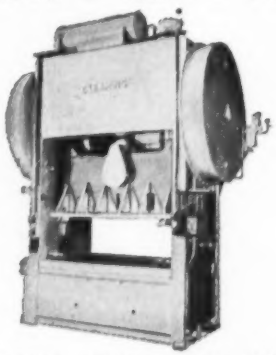

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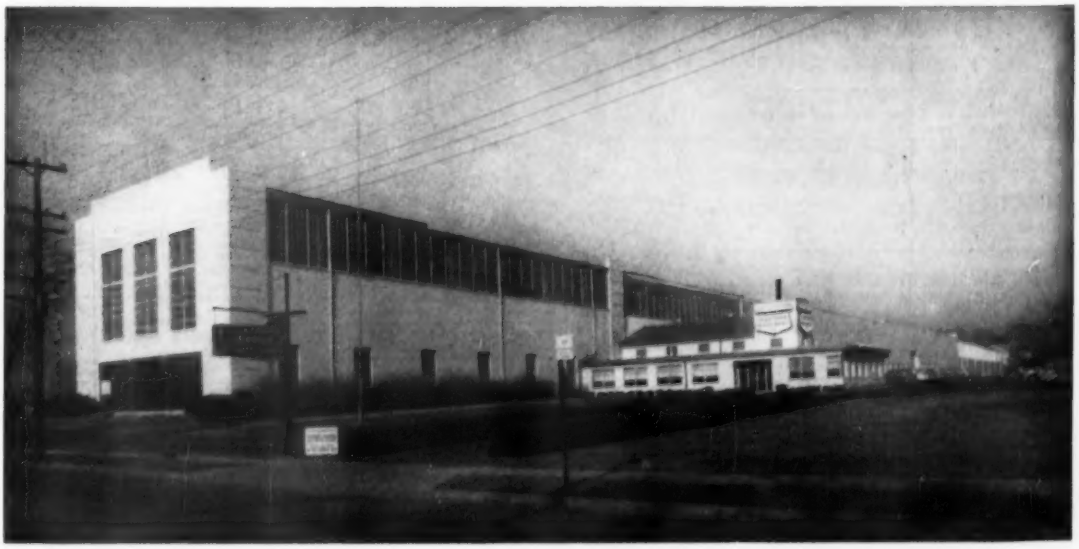

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12"x6' Lodge & Shipley, m.d.

12x84" centers Lodge & Shipley Geared Head, m.d., taper

13x48" centers Pratt & Whitney Geared Head, m.d.

13"x42" centers LeBlond "Regal", m.d.

14"x30" centers Hendey Geared Head, m.d.

14"x32" centers Cincinnati Geared Head, m.d., late

14x6' Hendey Geared Head, m.d., taper

14"x6' Lodge & Shipley Geared Head, m.d.

14"x16' Pratt & Whitney, cone

14"x6' LeBlond, cone

14"x6' LeBlond, Geared Head, s.p.d.

14"x8' bed Monarch, cone, motorized

14"x6' Sidney Geared Head, m.d.

14"x6' Springfield Geared Head, m.d., taper

15"x42" centers LeBlond "Regal", m.d.

16"x30" centers Monarch, m.d., taper

16"x6' bed Cisco Geared Head, m.d.

16"x6' Hendey Geared Head, m.d.

16"x6' Hendey Yoke Head, m.d., taper

16"x6' Lehmann Geared Head, m.d.

16"x6' Lodge & Shipley Selective Head, m.d.

16"x6' bed Monarch Geared Head, m.d.

17"x6' LeBlond Geared Head, m.d.

18"x48" centers Lodge & Shipley Geared Head, m.d.

18"x6' American, 8 speed, m.d.

18"x5' LeBlond Geared Head, m.d.

18"x6'6" Greaves-Klusman Geared Head, m.d.

18"x8' bed American Geared Head, m.d.

18"x8' Hendey Geared Head, m.d., taper

18"x8' Lodge & Shipley Geared Head, m.d.

18"x8' Whitcomb-Blaisdell Geared Head, m.d.

18"x10'6" bed Boye & Emmes, cone, motorized

19"x8' bed LeBlond Geared Head, Timken, m.d.

19"x10' bed LeBlond Geared Head, m.d.

19"x78" LeBlond, m.d., late

20"x16' bed Lodge & Shipley G.H., m.d.

20"x48" centers Head-Prentice Geared Head, m.d.

20"x48" centers LeBlond, m.d.

20"x72" centers Monarch Geared Head, m.d.

20"x72" centers American, m.d.

20"x8' bed Lodge & Shipley Geared Head, m.d.

20"x8' bed Greaves-Klusman Geared Head, m.d. in leg

20"x8' bed Boye & Emmes, m.d.

20"x8' bed Cisco, cone, motorized

20"x10' Sidney Geared Head, m.d.

20"x10'6" Boye & Emmes, cone, motorized

20"x11'9¾" centers Lodge & Shipley, m.d.

21"x8' bed LeBlond Geared Head, m.d., taper

23"x84" centers LeBlond Heavy Duty Geared Head, m.d.

24"x12' bed American, m.d.

24"x12' bed LeBlond Geared Head, m.d., taper

24"x12' bed Boye & Emmes, belt drive

24" raised to swing 32"x22' bed—16' centers—New Haven, cone, taper

24", 51¼" Lodge & Shipley Lathe, m.d.

24"x72" centers LeBlond, m.d.

25"x10' bed LeBlond Geared Head, m.d., taper

25"x10' centers LeBlond Heavy Duty G.H., m.d.

30"x12'6" bed Niles-Bement-Pond variable speed m.d., taper

36"x84" centers American "Super-Productive", m.d.

40" raised to 48½"x108" centers LeBlond, m.d.

42"x14' bed American Geared Head, m.d.

42" Putnam raised to swing 56½"x20" bed Geared Head, m.d., 11'8" centers

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24" x 12' BOYE & EMMES Grd. Head, Timken Bearing, Taper Attachment.

4 DE POTTER & JOHNSTON Automatic Turret Lathe. Late Type.

27" x 18' MONARCH "N" Geared Head Lathe, 11' Centers, Taper Attachment, Full Equipment. Late Type. 1942.

24" x 36" BULLARD Vertical Turret Lathe, Turret Hd., Side Hd., M.D.

No. 2, 4, 6 WARNER & SWASEY Univ. Turret Lathes, Bar Feed.

No. 2, 7 BARDONS & OLIVER Universal Turret Lathes, Preselector, Bar & Chucking. Late Type.

DRILLING MACHINES

3', 4', 5', 6' CINCINNATI BICKFORD Radial Drills.

6 Spindle No. 2 LMS Leland-Gifford Drill Press. Late Type.

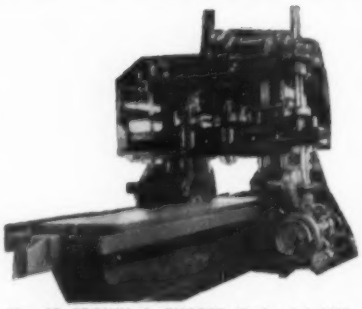
No. 2 M. T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive. Late Type.

MILLS

#2B KEARNEY & TRECKER Univ. Horizontal Vertical Head. M. D.

No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D. Late.

1A PRATT & WHITNEY Jig Borer, with Gauges, Rods, Collets and Chuck.



No. 2B BROWN & SHARPE Horizontal Mill, Motor in Base. Late Type.

42" by 36" x 12" INGERSOLL Planer Type Mill, two heads on rail, two side heads, M.D.

PRESSES

No. 91-C TOLEDO Straight Side Double Crank Power Press, 27" x 36" Bed Area, 60 tons cap., M.D.

No. 8 BLISS CONSOLIDATED 90 Ton Cap., O.B.I. Geared. Air Cushion. M.D.

400 Tons CHAMBERSBURG Hydraulic Wheel Press, 14" Ram, 96" between Tie Bars, 12' to End Support, M.D.

GRINDERS

No. 2 CINCINNATI Universal Tool & Cutter Grinder. Late Type.

4" x 12" LANDIS Hydraulic Plain Cylindrical Grinder, M.D. Late Type.

6" x 18" NORTON Hydraulic Horizontal Surface Grinder, Permanent Magnetic Chuck, Coolant System, Late Type.

No. 14 W HAMMOND Double End Carbide Grinder, M.D.

6" x 10" x 48" NORTON Hyd. Horiz. Surf. Grinder, M.D.

4T SELLERS Tool Grinder, M.D. Late Type.

30" INGERSOLL Face Mill Cutter Grinder, M.D. Late Type

6" x 18" LANDIS Type "C" M.D. Hyd., Cylindrical Grinder, Serial #29196.

No. 208 BESLEY Motor Driven Disc Grinder, 26" Wheels. Late Type.

MISCELLANEOUS

18 KW SCIENTIFIC ELECTRIC Induction Heater, Tube Type.

6' x 14 ga. WYSONG & MILES Shear

No. 8LS FELLOWS M.D. Gear Lapping Machine, Detachable Head, Univ. Work Support.

No. 1, 2, BUFFALO FORGE Vertical Angle Bending Rolls, M.D.

½, 1½ BUFFALO FORGE Universal Ironworker, Notcher and Coper, M.D.

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine, M.D. Late Type.

No. 6 BROWN & SHARPE Automatic Screw Machine, M.D., 2" Capacity.

10' x ¼" WYSONG & MILES Power Squaring Shears, Motor Driven.

10' x ⅜" Cap. LONG & ALLSTATTER Shear.

No. 194 BARNES Vertical Hone, 4" Capacity, 12" Stroke, M.D.

12" PRATT & WHITNEY Vertical Shaper, Keller Attachment. Late Type.

12" ROCKFORD Hydraulic Vertical Shaper. 1953.

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Nos. 2B Reid, 3B Abrasive, Surf.
36"x42" Pratt & Whitney Die & Surf.
30"x120" Hanchett Plane, Surf.
10"x96" Cinci, Plain Cyl.
LATHES, 25"x192" Cen. Lehmann, T.A.
18"x48" cen. Monarch, '42
20"x54" cen. Reed Prentice '43
TURRETS No. 2H10 Libby 10½", '43
Nos. 5 & 3 B. & O. '43
No. 3 Gisholt, Bar Chuck, '42
ROLLS, 10'x¾" Bertsch Pinch '43
SHAPER, VERT., 12" Pratt & Whitney, 1942
SLOTTER, 36" Rockford, Hyd., '44

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#5H K & T Horiz MILL w/vert head, 1942
#4H K & T Vert MILL 16 speed, 1943
#C225H Natco 12 spdl (adj.) DRILL, 1942
30" Rockford Openside SHAPER 2 heads
6 oz. HPM Inj. Moulding PRESS, New Contr.
75 KW Tocco INDUCTION Unit 3 Station, '44
22x84 Sidney H.D. 32 speed LATHE, 1952
#3 W & S 12 speed T. LATHE, bar feed, 1944
CT-36 Lees Bradner Univ THREAD MILL, 1944
Cinc. Centerless LAPPER, Filmatic, 1951

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7½" National Upsetter, Air Clutch, new 1944
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48" Newton continuous rotary mill.
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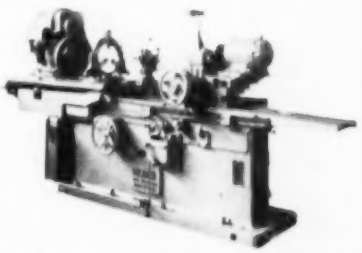
No. 8 Buffalo Bar & Billet shear.
Model 5-48 Cincinnati hydraulic duplex mill, new 1941.
Model 34-36 Cincinnati duplex mill, serial 3B33D14-4.
No. 74 Heald hydraulic plain internal grinder, w/cross-sliding H.S., new 1941.
No. 72A5 Heald hydraulic plain internal grinder w/extended bridge, new 1943.
No. 1-H-18 Kearney & Trecker simplex mill, late.
2000 Ton No. 6 National Maxipress, all steel frame.
7" No. 76H Baird Chucker, new 1943.
Pratt & Whitney Kellering Machines (6).
Mädel M24 Kearney & Trecker manufacturing mill, new in 1945.
16 Spdl No. D20H Natco multiple drill, 1943.
36" No. 36H Gould & Eberhardt gear hobber.
No. 2 Cincinnati filmatic bearing centerless grinder.
4" x 12" No. 4H Landis plain hyd. cylindrical grinder, 1943.
13" x 60" Hanchett vert. spdl. surface grinder, late.
6" x 18' Norton horiz. spdl. surface grinder.
126" x 96 ft. cc. Niles Bement Pond engine lathe.
15"x30" Lipe Carbo-Matic production lathe, 1942.
36" Rockford hydraulic openside shaper-planer.
36" Rockford hydraulic vertical slotter, new 1944.



(3) No. 72A5 Heald hydraulic internal grinder with extended bridge, serial No. 19331, new in 1943. Completely rebuilt and guaranteed.

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Foote-Burt Vert. 26" sw, new 1941
#49 Heald Borematic, new 1944

DRILLS

1 spdl. 14" sw, #2 Avey, new 1945
1 spdl. 20" sw, #2LMS L-G., 1945
1 spdl. 24" sw, #2MA6 Avey, new 1942
1 spdl. 26" sw, #4MS L-G. hydraulic
2 spdl. 24" sw, #3 Avey, AC MD
3 spdl. 26" sw, #2LMS L-G, 1942
3 spdl. 24" sw, #2MS L-G. new 1942
4 spdl. 14" sw, #2LMS L-G, new 1942
6 spdl. 20" sw, #1LMS L-G, new 1943
#316-A Baker Univ. H.D., 1943
16 spdl. Fox #K60H, #2 taper, 1944

BORING MACHINES

Foote-Burt Vert. 26" sw, new 1941
#49 Heald Borematic, new 1944

GRINDERS

3"x12" #5 B&S, Rap. Trav., 1948
4"x12" #4H Landis, 1942
4"x18" No. 4H Landis 1943
6"x18" Norton Type C, new 1943
10"x18" Norton Type C, new 1943
10"x36" Norton Type C, new 1942
10"x48" Norton Type C, new 1942
10"x72" Hill-Clarke, AC Mot. Dr.
10"x96" Hill-Clarke, AC Mot. Dr.
10"-20"x36" Norton, angular wheel
14"x48" Landis Type C, new 1941
16"x72" Hill-Clarke, AC Mot. Dr.
16"x96"x72" Norton, AC MD, 1941
42"x72" Norton, extras, new 1947
18"x96" Hill-Clarke, AC Mot. Dr.
20"x192" Norton, AC Mot. Dr.
24"x264" Norton, AC MD, Rebuilt
26"-32" Gap x 114" Norton Pl. Cyl.
14"x48" Landis Type C Univ. chuck
#371 Heald Size-Matic, 1950
#5A Bryant Internal, new 1943
#16A-16 Bryant Internal, new 1943
#16-38 Bryant Internal, new 1941
#24-26 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A3 Heald Int. Sizematic, 1944
#72A5 Heald Internal, new 1942
#72A5 Heald Bridge Type Int.
#214 Besly Double End Disc, 1940
#8-2 Greenly Surf., 5"x8" Chuck
#3-B Abrasive Surf, 8"x24" Table 1942
#18-30" Blanchard Rot. Surf.

LATHES

16ML-16"x36" LeBlond Auto.
#16ML-16 LeBlond, Semi-Auto. 36" cc
14"x36" Amer. Grd. Hd., MD
27"x84" Amer. Grd. Hd., MD
24"x42" Fay Auto AC MD
36"x126" Putnam Grd. Hd., MD
R14 Seneca Falls, 16"x36", 1942
120"x96" cc N-B-P, ser. 3389
#5W Cinn Acme Univ. Turret
#4 Gisholt Univ. Tur., A.C.& B.F.
#3AL Gisholt, cross slide Tur. 1941
#3F-10 Libby H.D. Tur. 1942
#4A W&S Turret, new 1944
#PU Fastermatic, tur. 33" sw, 1944
#8D Potter & Johnston, new 1941

MILLERS

54"x30"x16 Ingersoll Slab, 1934
54"x8" Ingersoll Openside, 1942
54" Ingersoll Vertical Rot.
#9V Davis & Thompson Vert., 1944
#12-B Pratt & Whitney Profilers
10"x60" P&W Mod. B Thread Mill
#CT L-B Thread Mill new 1942
No. 2 Cinn. Univ. Hi-Power
#36 Van Norman, Rebuilt, 1941
#1-18 Van Norman Prod. 1942

PLANERS

36"x36"x12' Rockford Openside '42
60"x48"x27' American, 4 hds.
60"x48"x30" Hamilton, 4 heads

MISCELLANEOUS

#3L La Pointe 15T Hosts, Broach
6" Gens & DeLeeuw 6 spdls. 1941
#506 Barnes Vert. Hone, new 1942
15 Ton Hyd. American Press, 1946
#11RD 2 Hd. W&S Tapper, latest
#36BM G&E 2 Spdl. Beam sa.
#61A Fellows Gr Shaper (8" cap.
#5A Kaufman Press Tapper, 1941
#HRB Barber-Colman Sharp Mach
16 gn. 42" Economy Power Shears
6"x6" Peerless H.D. Hacksaw, 1941
15 T Toledo Overhead Crane, 1944

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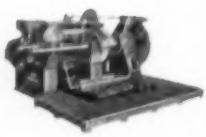
Hypoid and Zerol Bevel Gear Grinder, with "Automatic" cycle, wheel - dressing, etc. Perfect condition.



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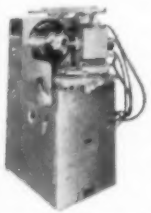

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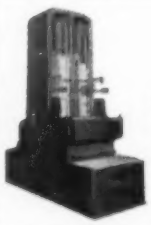

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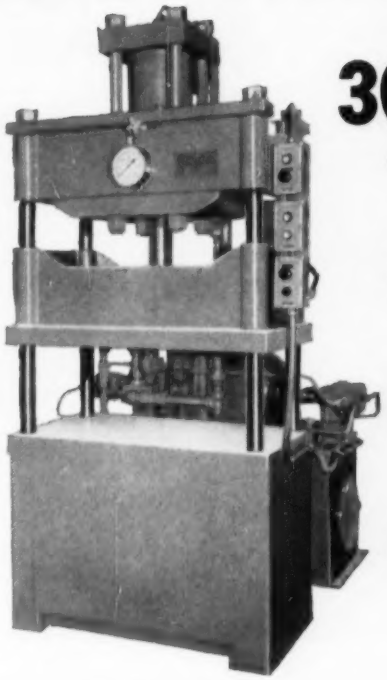

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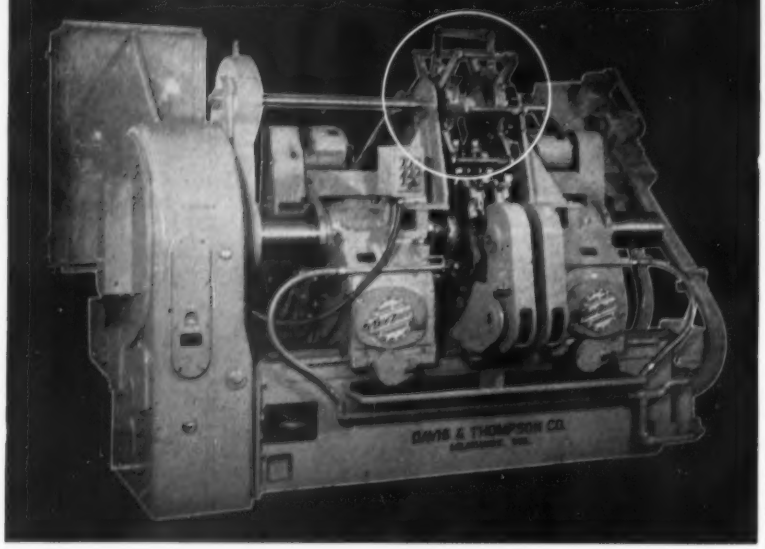

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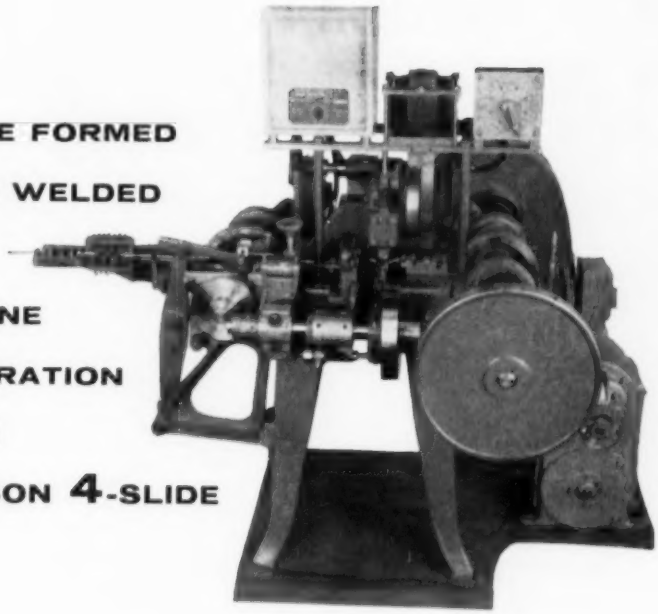
WIRE FORMED AND WELDED IN ONE OPERATION WITH NILSON 4-SLIDE



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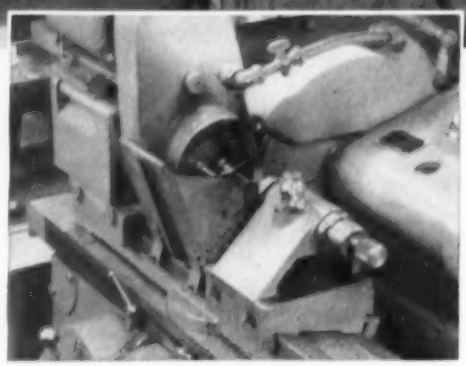

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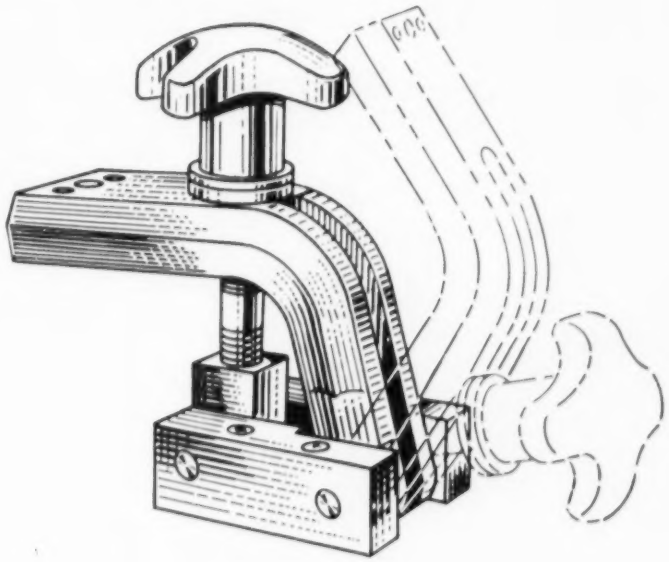

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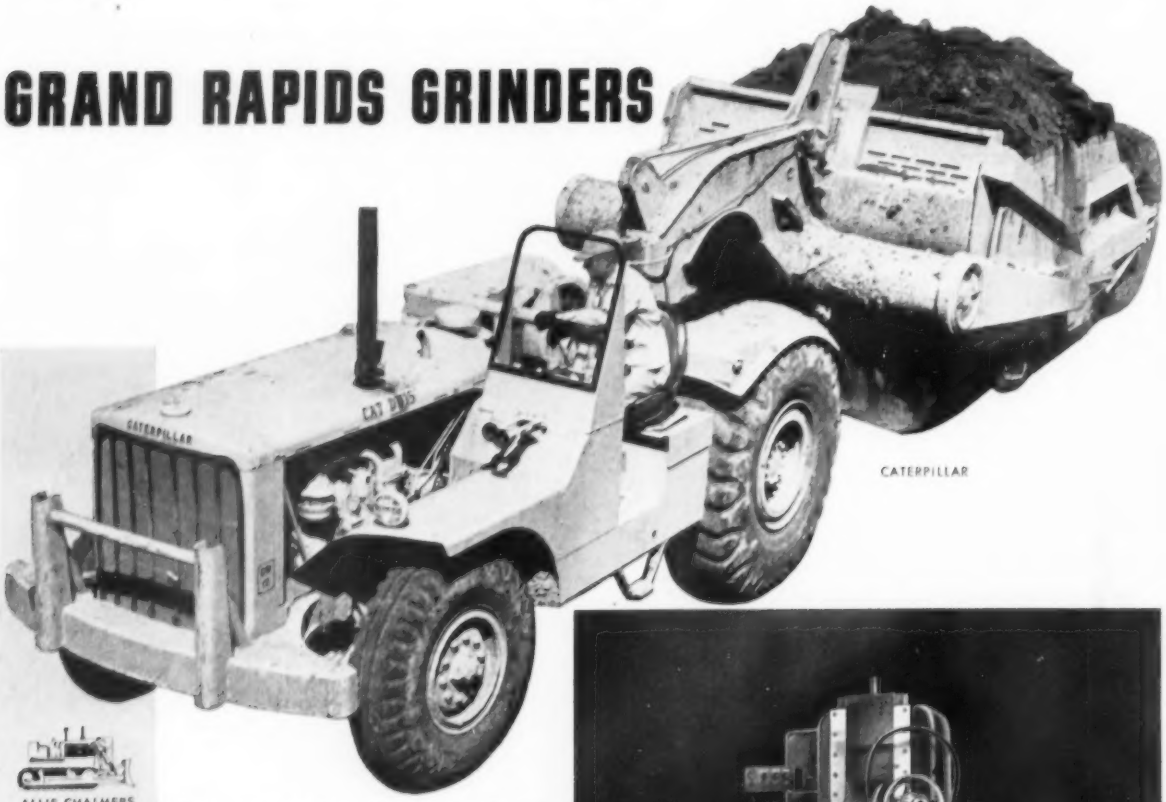

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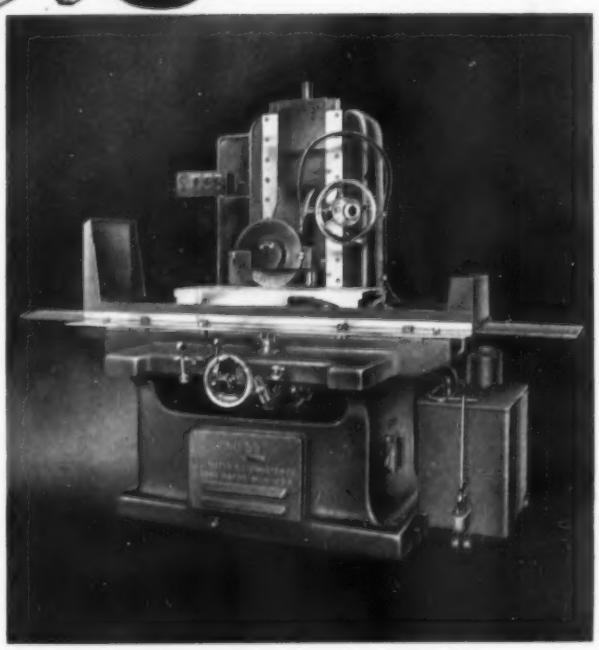

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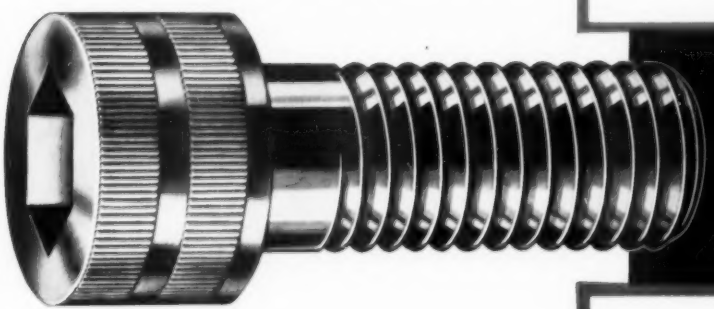

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THE HOLO-KROME SCREW CORP. HARTFORD 10, CONN.

SET SCREWS
For safety and high holding power.

BUTTON HEADS
Where countersinking is impractical.

CAP SCREWS
For high strength and compact design.

FLAT HEADS
For a smooth, unobstructed surface.

PIPE PLUGS
Precision threads for the tightest fit.

SHOULDER SCREWS
For concentric head, shoulder and thread.

DOWEL PINS
Special finish is corrosion-resistant, facilitates driving.

Produces automotive parts automatically ...with TIMKEN® bearings, the precision is automatic, too

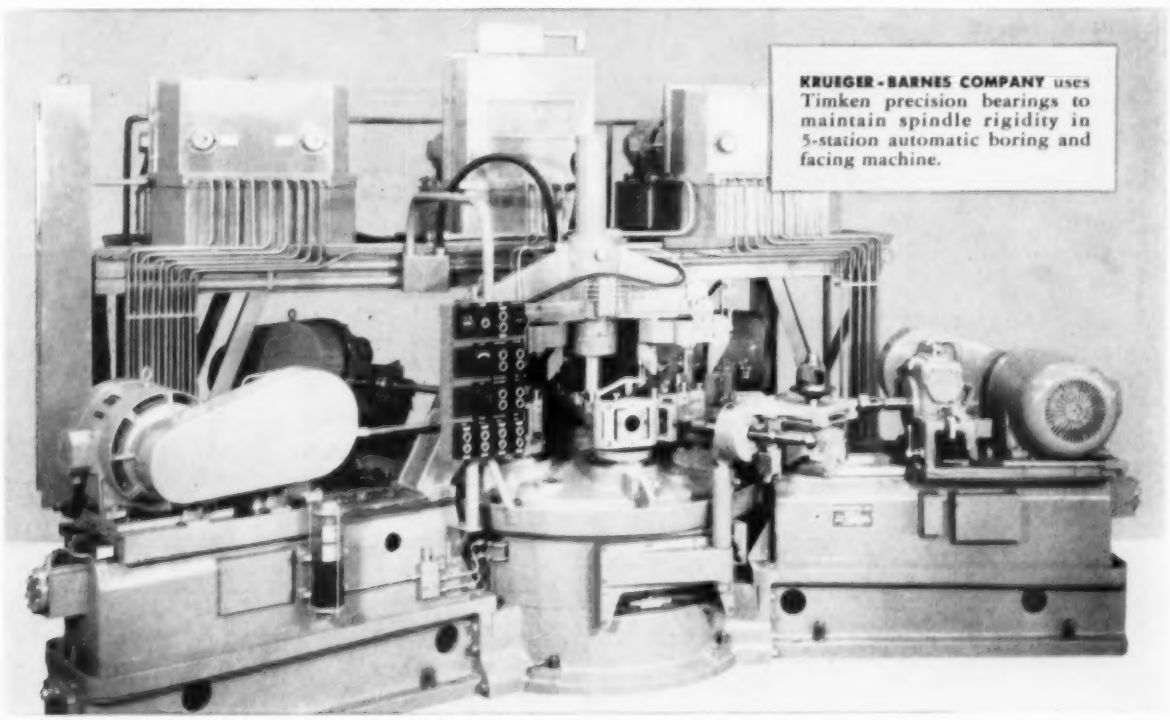
KRUEGER-BARNES engineers designed this 5-station milling and boring machine to produce automotive differential cases semi-automatically. To be sure its precision was automatic, too, they mounted the 5 spindles on 10 Timken® tapered roller bearings. Timken bearings take the work loads, keep the spindles rigid through hour after hour, shift after shift of high-speed operation. And they do it with a minimum of attention and maintenance.

Timken bearings maintain spindle rigidity because their tapered design lets them take both radial and thrust loads in any combination. And full line contact of rollers and races in Timken bearings gives them extra load-carrying capacity.

Timken bearings are designed by geometrical law to have true rolling motion and precision manufactured to live up to their design. Manufactured with an incredibly smooth surface finish, Timken bearings virtually eliminate friction, help keep machines on the go with less maintenance.

Since Timken bearings are engineered for the job, precision manufactured and made of special analysis Timken fine alloy steels, they normally last the life of the machine. In machine tools as in all machinery, wherever wheels and shafts turn, Timken bearings are your No. 1 value. When you build or buy machines, specify Timken bearings. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



KRUEGER-BARNES COMPANY uses Timken precision bearings to maintain spindle rigidity in 5-station automatic boring and facing machine.

PROFILOGRAPH TRACE · GOOD COMMERCIALLY GROUND FINISH (5,000 X VERTICAL, 50 X HORIZONTAL)

PROFILOGRAPH TRACE · TIMKEN BEARING FINISH (5,000 X VERTICAL, 50 X HORIZONTAL)

OPTICAL FLAT · PERFECT FINISH

SMOOTH TO MILLIONTHS OF AN INCH

Surface finish of high quality Timken bearing rollers and races is so smooth that it takes a profilograph to measure its smoothness. This instrument measures surface variations to a millionth of an inch, as shown at the left.

TIMKEN

TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ═ THE TIMKEN TAPERED ROLLER ═ BEARING TAKES RADIAL ↓ AND THRUST →═ LOADS OR ANY COMBINATION